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THE PHILOSOPHY OF MANUAL TRAINING.

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I.

IT is said of a well-known American Hegelian and educator that he always starts out with Adam and Eve. The method is thorough, but it gives a long preface. I may seem guilty of the same tendency when in writing about manual training I appear to write about everything else, and very seldom directly about the subject in hand. But this is precisely what I expect to do, and I expect to do it for the sole purpose of throwing light on manual training.

No scheme of education has any serious claim upon our attention unless it is founded upon some rational system of ethics—that is to say, upon some rational view of the proper conduct of life. And the foundations of any acceptable scheme of ethics must be laid deep in the broadest generalization of all, in our philosophy of life.

Education then, is not an inductive but a purely deductive science.

It is true that every primary science, in the course of its historical development, passes through two distinct stages: the stage of induction, in which from the study of special cases we are led to the perception of a general law or principle; and the stage of deduction, in which from this body of general principles we work out a whole series of special and important conclusions. This double course of development is now so well recognized that we are withholding the name of science from those branches of inquiry which have not yet reached the deductive stage. Comte's test of science was the power

of prediction. This power comes only when we have such a store of general principles to consult, and can with their help state with confidence just what will happen under any given set of conditions.

Judged by this stricter standard, many of our so-called sciences are only now earning the name. Chemistry is an excellent case in point. For many years it was purely inductive. Every new reaction was very properly described as an experiment, for no one knew precisely what would happen. It is still largely experimental. But out of this accumulation of experimental data there are slowly emerging a few general principles which give us the power of limited prediction.

It is the same with physics and the group of studies generally classed as natural sciences. Some of them, such as mineralogy, are hardly sciences as yet, since they allow small deduction. Similarly with the group of studies that may be called the human sciences—sociology and economics. So far as they are primary, they must first be studied in their manifestations, and any general laws wrought out from just such a mass of details.

These remarks are limited to the primary sciences. The distinction between these and what may be called the secondary sciences is of great practical importance. I conceive those to be primary which are, so far as we know, self-founded, and must perforce work out their own laws. The first stage of their development is necessarily inductive, for they have nothing to build upon except direct and immediate experience. And I conceive those sciences to be secondary which receive their laws at second hand, if we may so phrase it, from some more basic science, and simply apply them to a special class of conclusions. Such sciences are necessarily derivative in origin, and must proceed deductively. The present trend of scientific opinion is to recognize but one science, mechanics, as fundamental or primary, and to regard all other sciences as secondary. It does this when it attempts to explain the phenomena of these sciences by referring them to mechanical principles. With the progress of scientific generalization we may look forward to a time when there will be but one theorem in the geometry of Nature, and the separate sciences of to-day—biology, physics, chemistry, sociology, and the rest—will assemble themselves under this theorem as a series of manifest corollaries.

And I may say that such a view, suggested with increasing emphasis by the experimental sciences, is also in harmony with the deepest generalization of a more abstract philosophy, which sees in the universe the operation of but one power. It is also interesting from a metaphysical point of view to notice that of all the concrete sciences, the one chosen as fundamental—mechanics—is just that

science which embodies the largest *a priori* elements with the least possible external elements.

I have said that education is a purely deductive science, and the reason now becomes plain. It is necessarily a secondary science, since it depends, not upon any self-contained principles which may be brought to light by careful inductive reasoning, but solely and entirely upon external considerations—that is to say, upon the social ideals growing out of our accepted ethics and philosophy, and upon the methods which our current psychology suggests as the proper means of realizing those ideals. It is for this reason impossible to study education, and much less any specific scheme of education, such as manual training, at first hand, as a thing in itself. Education can not evolve its own laws, can not be said to have any definitely discernible end and purpose of its own. It is purely a process—a delicate, subtle process by which psychological methods are made use of to attain social ends. In saying this, one does not belittle the function of education; one magnifies it. I should then be treating manual training in a most superficial way, alike unjust to it and to the reader, if I considered it other than I propose to consider it—as a part of a larger plan.

Emerson, and others less inspired than he, have repeatedly pointed out to us how prone we are to mistake the means for the end. And this is nowhere more marked than in education. We start out very badly as students of education when we erect it into an end in itself. It is very far from being an end. It is simply a means, the servant of a higher science, the servant of the social ideal.

I have always cherished a sympathetic interest in the progress of American architecture. It is an interest that survives the years, and I constantly find myself looking at new buildings and at old with half-closed eyes, and through my lashes—which they tell me is a sure sign of the artistic temperament. But, be this as it may, what I see, even with half-closed eyes, does not, in the main, please me. I see a dreary succession of unbeautiful buildings. And I ask myself the cause. The American schools of architecture are admirable. The work done in several of them will bear comparison with the best work done at the *École des Beaux-Arts* in Paris, and the *École des Beaux-Arts* is, I believe, the Mecca of all our young architects. And in contemporary architecture it is not boastful, I think, to say that America is abreast of the world. Nowhere in Europe will you find more beautiful modern buildings than the Public Library in Boston, the Madison Square Garden in New York, or the Pennsylvania Station, before it was spoiled, in Philadelphia. And yet the mass of our buildings are hopelessly ugly. Many of these aberrations are due to poor architects, for the profession is not

yet limited to men of taste; but for much of the ugliness, and especially the suburban ugliness, we are indebted to that individual known as the architect and builder. I need not enlarge upon his sins. You will, perhaps, see him at his worst in San Francisco, where eleven bay windows are sometimes bestowed upon one small house.

The characteristic of the architect and builder is excess of action and deficiency of thought. He looks so long and so steadily at the mere process of building, at the operation itself, that he quite forgets to ask whether what he builds is beautiful or suitable. He belittles the graver function, the designing. The putting of architect before builder on his signboard is merely for trade purposes. Even excellence of workmanship is no extenuation for such social crimes. No matter how strong and solid and tight an ugly, inconvenient building may be, it remains a social offense, for it has done violence to the higher and essential requirement.

The same criticism must be applied to the schools. They are not admirable simply because they are alert. They may do with rigor and vigor many things that had better be left undone. However well and thoroughly their methods may be carried out, they are a poor thing, after all, if what they create is not beautiful and seemly. Back of the hundreds of builders who put together the Public Library, the Madison Square Garden, the Pennsylvania Station, stand the several true architects in whose hearts and brains these buildings first took shape. Ten million builders could never alone have created so beautiful a result. It was not in them to do it. And as an old lady once said in speaking of her sister-in-law, "You can't get more out of people, my dear, than there is in them."

Back of everything that is noble and beautiful you will find a compelling idea. Back of the five hundred thousand teachers in America, who are to-day fashioning sixteen million young minds into patterns beautiful or grotesque, there should stand the compelling impulse of a high social idea.

The main question in education, indeed, I may say the *one* question in education, is simply this, What type of men and women do we wish to prevail? What *is* the social ideal toward which we wish to work? And the one question of method is, What process will produce this type, will realize this ideal?

I need not point out that the question of method can not possibly be answered until the first question is definitely settled. That would be a perfectly useless journey which had no objective point in view. Yet I think it is no exaggeration to say that the very large majority of teachers and school boards have very vague ideas indeed as to where they want the children to be landed when the formal process

of education comes to an end. And these ideas are not only vague, but frequently they are contradictory as well, and so the long journey turns out to be aimless.

To attempt to formulate, and particularly to formulate for others, what would be a reasonable ideal of life, is to put one's philosophy to the supreme test. When I look about me on the drama of life—when I look within, upon the drama of my own life—what is it that stands out above the rest as the very necessary and essential thing? What constitutes the most evolved conduct and animates the most evolved people? In putting such basal inquiries as these it may be thought that, like the Hegelian I mentioned, I am going back almost as far as Adam and Eve. But unless one is willing to ask such questions one's speculations will continue to play forever about the surface of all educational problems, and will never strike into the heart of the matter.

In the first place, then, how much of conduct does education cover? The answer is not far to seek. If education be a process for the realization of an ethical ideal, it must have to do with all that part of human action which is touched with morality—that is, with conduct as a whole. And what constitutes conduct? Arnold says that conduct is three fourths of life. Spencer says that it includes all action which involves a purpose. But the ethical teaching of these undoubted masters of ethics may, I think, be profitably extended. A keener scrutiny of cause and effect throws out the fractions and dispenses with the qualifications. Conduct has to do with the whole of life, and education, which has to do with conduct, must have to do with the whole of life. There is no action which is ethically indifferent. Even the bodily functions, the act of breathing, the beating of the heart, the process of digestion, which in health are so automatic that we are quite unconscious of them, are nevertheless the product of knowable conditions, and as such are under the indirect control of the informed spirit.

Whether the breathing be long and deep, bringing with it the power of wholesome, manly action, is a moral question. Whether the pulse beat be strong and steady, sending the blood coursing through the veins and making one the center of a radiant helpful life, is a moral question. Whether the digestive apparatus is doing good work, renewing and refreshing the tissues, is a moral question. Since all these functions are open to modification, they are open to improvement, and the *quality* of the life dependent on them may be made better or worse. In the last analysis, every act of life, be it bodily or intellectual, is morally significant. Modern man has tasted too deep of the tree of the knowledge of good and evil to plead ignorance and hide when the lord Con-

science walks through the garden of his spirit in the cool of the evening. I must not linger too long over this idea. But it is a transforming idea. It allows no act of life to be commonplace. It makes every act of life a moral act, and if it be touched with emotion it makes every act of life a religious act. It is a thought to awaken enthusiasm, for it seems to me in a very real sense to transfigure life.

All conduct, all action, is, then, either good or bad; not good or bad abstractly and absolutely, but good or bad with respect to some tangible end. But this relativity must always be kept in mind. A coat is good in winter if it keeps us warm; it is good in summer if it keeps us cool. A shot is a good one if it goes straight to the mark. A machine is a good one if it does the required work. The criterion of the thing seems to lie in this, whether it is well or ill adapted to the end in view. It is precisely the same with conduct. Evolved conduct is marked by a nice adjustment of means to ends.

Now, a thoroughgoing analysis of every scheme of life shows that happiness, whether it be called such with all frankness and sincerity, or whether it be called blessedness, or virtue, or perfection, is in reality the final end. The immediate end must be the means to happiness, and morality, the art of right living, must consist in the realization of these means in the fullest possible measure. But bear in mind that happiness is not self-existent, a bright light shining in the darkness of the unfelt. It is a state of individual consciousness, which results from the gratification of individual desires. You remember what Omar Khayyám says:

> "I sent my Soul through the Invisible,
> Some letter of that After-life to spell;
> And by and by my Soul returned to me,
> And answered, 'I myself am Heaven and Hell.'
> Heaven but the Vision of fulfilled desire,
> And Hell the shadow of a Soul on fire."

The moral life consists in realizing the utmost attainable measure of happiness, and this, not alone for one's self, but quite as ardently for one's children and one's fellows. It is not a selfish scheme of life, not happiness for one's self and misery for others, but happiness as a universal end. It means fullness of living, the entertaining of manifold desires and interests, and their most complete and rational gratification. It is a divine abandon, rather than a narrow asceticism; extravagance, rather than parsimony. Plato, you may remember, speaks of the world as the product of the divine *ungrudgingness*. What an unparalleled description, and how pleasant to repeat to one's self in the midst of a commercial age! The human life which most nearly approaches the divine is steeped in

this same generosity and openness. We want to drink greedily of this cup of life. We want to press it upon others, for it is good. This is not alone the teaching of modern science. It is, as well, the song of modern verse.

Life in its fullness and totality means much. It means youth, manhood, and old age. It means one day and all days. It means the life of the body, that it shall be clean and sweet and wholesome; it means the life of the intellect, that it shall be keen, inquisitive, receptive, creative; it means the life of the emotions, that they shall be strong and deep and human.

These needs of the complete man, these needs of the body, of the mind, of the heart, must be recognized and gratified if life in its fullness and totality is to be realized. Human nature is many-sided, and in this consist its charm and its promise. Not one of its many sides may be neglected. As Spencer puts it, "The performance of every function is in a sense a moral obligation." The social ideal which philosophy and ethics press upon us is not that of an economical community, but rather that of a community touched with the divine ungrudgingness, a community made up of men and women of large needs, large appetites, large hearts, large capacities for receiving and giving pleasure, and in addition equally large opportunities for gratifying to the full these many sides of an enriched human nature.

Do you realize that to-day nine tenths of our people, perhaps more, are leading starved lives, and the pity of it is that they don't even know that they are starved? It is the mission of social culture to arouse these benumbed spirits, to set them on fire with the vision of the complete life, to quicken the social conscience so that it shall not rest content until these, our brothers and sisters, shall have drunk to the full of the riches and glory of life. The social ideal of philosophy and ethics has little to do with the economic law of supply and demand, and much to do with the human law of need and fulfillment. To accomplish this end, to open to each soul the fullest life of which that soul is capable, is manifestly the social purpose of which education is the formal process.

In deciding upon the type man and woman we wish to have prevail, we assuredly stand at the parting of the ways. The more definite and concrete ends appeal to practical minds, because they seem the more attainable. But if, my friends, a careful analysis of life shows—and I am sure that it does show—that these ends are not the major ends, it is surely a poor victory to compass them and to leave the major ends unessayed.

We stand to-day in the midst of much educational activity. We see a great deal of dull, routine work, but we also see many new

departures, teachers with their own particular methods and special ends. I should be the last to disparage this attempt at originality, for out of it in the end some good will come. But when I look upon it, and upon its first harvests, I am constantly reminded of some wise words of Arnold's—words to the effect that not alone must we live up to the light that is in us, but as well must we see to it that the light be not darkness. These are simple, homely words, but if they once lay hold upon your spirit, they have a compelling force that is imperative.

It is not uncharitable, I think, to say that much of this educational activity is one-sided. Analyze it for a moment. Here is a man who has looked so long and so steadily upon the function of government that he has lost all sense of proportion. The giant apparition of the State has obscured the other sides of life, and has come to occupy the whole field of vision. He sees in men only citizens, and in children only possible citizens. The one study is civics, and education groups itself around that. Here is another man, upon whom the bread-and-butter study has made a too deep impression. When he reflects upon life, the pale and haggard faces of the poor stare at him, and their thin and ragged garments flutter in the wind of his imagination. In the rich city of New York a woman died of hunger. It is horrible. The daily loaf stands out in large dimensions and obscures the rest of life. The one study becomes for him the bread-and-butter study, and education gives place to industrial training. Here is still another man who has busied himself with questions of rent and wages, profit and loss, currency and land, free trade and protection, until these tools of social life become for him the life itself, and the great issue—it seems a sacrilege to say it—is plainly economic. And another, who sees in trade and shopkeeping the blood of life, and would make arithmetic and bookkeeping and business practice the food of children. Or another, who is impressed with numbers, and who believes that New York and Chicago are great cities because of their millions of people. To him children are socially interesting as future mothers and fathers. His cry is the vainest of all. It is the *race*. Nor should I omit in even so partial a survey that large group of men and women who rightly hold the achievements of the human spirit to be very precious, but who see, unfortunately, in the vehicle which brings these records from the past into the present—that is to say, in language—a thing as worshipful as the achievements themselves. Are we to forget that Thucydides and Zenophon were soldiers, that Goethe was a chancellor, and Shakespeare an actor; that all the men and women who have reported the spirit worthily have been men and women who have tasted life, and have had something to report? Are we to forget that

in the age of Pericles, that flowering time of the human spirit, there was but one language held worthy of study—the native tongue? To look too steadily upon the vehicle of thought and erect that into an end is to make no less grave a mistake than was made in the other partial ends that we have examined and rejected.

But it is un-Froebelian and unphilosophic to dwell too long upon the negative side of things. The materials of life are positive. I have had a purpose, however, in stopping so long among these negations. I have wanted to make it very clear that these ends are partial and fragmentary, and quite unworthy of those who seek the highest good. If one still believes that citizenship, or industrialism, or economics, or trade, or parenthood, or language, is a defensible end of education, it will be difficult to concentrate the interest upon a worthier image.

It is not idle to let one's imagination and one's love play about this image of the complete man, to picture him in all his beauty of body, of intellect, and of heart, for it is only by thus entertaining this conception and making it thoroughly our own that we shall ever have it prevail, and ever have the educational process conform to this as its ideal product.

It is perhaps convenient for purposes of study to consider man in the threefold aspect of body, intellect, and heart. But the division is not true to Nature, and if it blinds us to the essential unity of man, it is an expensive convenience that we had much better do without. The common conception of his nature is dualistic. He is body and spirit, or he is body and soul. This conception, which from an educational point of view, is certainly unfortunate, is founded upon the current dualistic philosophy, which discerns a universe made of mind and matter. Even more particularly is it founded upon that theological dualism which makes the spirit and the body the most unhappy of partners, forever at warfare, and each defeating the other's best interests. It is a philosophy whose logical extreme is asceticism, and would land us all, like poor Simon Stylites, on top of a pillar of useless renunciation. It would lead us to miserably dwarf our natures instead of gloriously expanding them. This bloodless philosophy is deeply instilled into us all, for it has been a part of our creed for many generations back. Even now, I find myself—and probably many of you do the same—when taken unawares, deciding that the disagreeable thing must be the right thing, and simply because it is disagreeable. The Jonathan Edwards in those of us who have inherited both the riches and the poverty of the New England blood is very apt to speak out and commit us to many such immoralities.

This dualistic philosophy is the very opposite of the philosophy

involved in manual training, and in the new education generally. The systems of education founded upon dualism must seem to us false and irreverent. The truer conception of life is monistic. It dwells not upon the shadows and the cold and the evil of life, the subjective demons of negation, but upon the brightness and warmth and goodness of life, upon the joy and sunshine and beauty of Nature. This is the positive material out of which we are to construct our world. And this vivifying, beautiful spirit comes to us not from Edwards and Calvin, but from men like Emerson and Froebel, men who believed in righteousness rather than sin, in light rather than darkness, in heat rather than cold.

Our image of the complete man is, then, the image of a unit, of an organic whole, and the educational process, whose sole function is to expand and develop and perfect this organism, must address itself to the whole task, and must deal with man as a unit, with his emotional, physical life as well as his intellectual life. And here, observe, we do not say that it is *desirable* to do this—we say that it is *necessary*. A modern educational scheme founded on dualism might profess that it were good to have a sound body and a warm heart as well as an evolved intellect, and might even work with some degree of intelligence and success toward the solution of the double problem. But the weakness lies in this, that the least pressure, a lack of time or equipment or power, and some selection is bound to be made, under the belief that one part of the problem may be solved apart from the others. It is impossible. It is *quite* impossible. Concentrate all effort upon the body, and we have an athlete who turns out to have not even good health. Concentrate all effort on the emotions, and we have a sentimentalist, who is neither loving nor lovable. Concentrate all effort on the intellect, and we have that sorry creature, the pedant, who does not even know.

Development must be continuous, and must proceed step by step. And this, let me repeat, not merely because it is desirable to have sound bodies, and warm hearts, and evolved intellects, but because they depend upon one another, and can not be separated. I conceive this unity of man to be the very basis of the new education. It is certainly the foundation of all we do in manual training. It is, therefore, a principle which invites the closest scrutiny. If this philosophy be true, if this doctrine of ethics be sound, if man is so essentially a unit, if his happiness and welfare are the business of morality, then we can not escape the conclusion that any scheme of education, to be a true scheme, must have its foundations laid deep in such a doctrine of ethics and such a philosophy of life. But if these be false, if between mind and matter there is eternal warfare, if the conflict between Ormuzd and Ahriman is to go on forever in the

human soul; if duty consists in a daily death, in the ceaseless thwarting of one's nature, in self-sacrifice in place of self-realization; if Satan be the reality that God is, then I believe that the new education is a sad mistake, a thing quite false, and that I could render best service by presenting manual training pathologically as a thing to be known in order to be avoided.

In thus seeking the philosophy of the new education, we assuredly stand at the parting of the ways. It is useless to blink the fact. Indeed, it is worse; it is cowardly. Let us frankly admit it—everything *is* involved. When you scrutinize your educational creed, you scrutinize your religious creed, your ethical creed, and your social creed as well. And until there is harmony among these, until your religion and your ethics and your sociology have been settled upon some rational basis, it is impossible for your education to be other than a poor makeshift thing, like the work of the architect and builder, showing an excess of action and a deficiency of thought.

Until one makes such a thoroughgoing examination of one's fundamental beliefs and reaches some degree of consistency, one can not teach one's self, one can not direct the teaching work of others. One can go through the emotions of teaching and can do infinite harm. Do you remember the story of the man who led the little ones astray, and the sad comment on his life—it were better that a millstone had been hanged about his neck and he had been drowned in the depths of the sea? It would be horrible in the end to feel that these words applied to us. If you have not the time to make such an examination, or, having attempted it, if you have not been able to reach any broad and human philosophy of life, it were better not to teach; it were better not to concern yourself with education; it were better, like Thoreau, to go to raising beans, for this at least you can do honestly. How can you hope to renovate others until you have renovated yourself?

As I see the matter, then, the philosophy of manual training, and of the new education generally, is plainly monistic. It sees in man not body and mind, with independent powers of action, and astonishing possibilities for conflict, but the contrary, a unit organism, with thinking and feeling among its essential characteristics quite as much as extension and impenetrability. And this organism is a sensitive one, responding to the stress and strain of desire and emotion, quite as readily as to mechanical forces, to the push and pull of bodily contact. What affects one aspect of this organism affects the other. If you touch the body you touch the spirit. If you touch the spirit you touch the body. One reacts on the other. The unfolding and perfecting of the human spirit is the object of manual training, as it is of all education.

This view of man, of unit man, offers a new avenue of approach to the spirit. Every good thought strengthens and vitalizes the body. Every wholesome exercise of the body invigorates the spirit. The action of each is carried out in terms of the other. See how wonderfully true this is. Each conscious act of the outer bodily life is first rehearsed in the inner thought life. If you stir, you do it first in thought. If you go on a journey, you go first in thought. If you build a house, you build it first in thought. If you work in your garden, you do it first in thought. An idea precedes each conscious act, is indeed the father of the act, the essential part of it. But the converse is just as true. The drama of the inner life would be quite impossible without the imagery and symbolism of the bodily life. Imagine, if you can, a formless, immaterial world, and then try to think. There would be no terms in which to think, and nothing to think about. It would be complete cessation of being. Thought is not carried out in terms of thought, but in terms of things. It is as dependent upon these as bodily action is dependent upon thought.

Regard for a moment the interaction between this inner and outer world. Every bodily experience affects one or more of the sense organs, and sends one or many impulses along the nerves to that central receiving station, the brain. And here something very wonderful takes place, something so wonderful that we have no explanation for it in the whole realm of empirical science. The nerve current setting in from the outer world to the inner world of the brain manifests itself there as a fact of consciousness, a sensation. All we know about it is that these impulses taken together produce that stream of thought which is the drama of existence. The richer and more varied these impulses or sensations, the richer and more varied the stream of thought. With meager sensation comes meager thought. We must cut the coat according to the cloth. This perceptual knowledge, this report of the senses is the only thing that comes to us, and out of it we build our entire world. Reflection and reason make use of this material, but they can add nothing to its original content. It is impossible to overestimate the importance of having the senses alert and keen that they may report the outer world accurately. It is impossible to overestimate the importance of giving the senses much to operate upon, the largest possible field that they may report the outer world fully. We want for the complete life, the fullest and most accurate perceptual knowledge, and we can only get this through the activity and training of the senses. The application in education is obvious. This is what constitutes the great difference in environment, and makes one favorable to growth and another unfavorable. A keen tool with nothing to

work upon, a dull tool with a wealth of material, can neither of them turn out much of value.

We please ourselves by saying that experience is the best teacher, that the world is the best schoolhouse, that travel is the best education. But in reality we prevent experience, we shut out the world, we disallow travel. We ask children to reason and reflect about a world that they do not yet know. Surely this is unphilosophic. We give them small perceptual knowledge—mainly what they get on holidays and when they play truant—and spend nearly all our time in attempting to build larger logical structures than we have the material for—bricks without straw. It is this that makes the school teacher's life hard. It is not working with the children. The children are the most lovable and interesting part of creation. It is in attempting impossible tasks. It is a very large part of the philosophy of manual training that the senses shall be alert and keen—good tools; that the brain shall be well developed and active —a good workman; that the store of perceptual knowledge shall be full and accurate—good material to work upon. And it seems to me that we have here a recognition of cause and effect that is not only in the highest degree logical, but is also far ahead of the position taken by any other scheme of education.

Furthermore, it is very evident that not only is every bodily act preceded by a mental act, but if it produce a new sensation is followed as well by a distinct mental reaction. The circulation is complete. If we arrange a series of bodily acts, we bring about a corresponding series of mental reactions, and if we arrange the bodily acts with sufficient cleverness, we bring about a series of mental reactions of high educational value. This is what manual training attempts to do—to utilize this newly apprehended avenue of approach to the spirit. It arranges a series of bodily acts, for the most part having to do with the hand and eye, and does so simply and solely for the sake of the mental reactions that follow upon these acts. While the term manual training is roughly descriptive of the outer fact, you will notice that the real purpose and essence of the training are mental.

I need not point out the evolutionary significance of such a training. If we accept evolution, if we believe that man is the reaction of the world environment on the human spirit, we will not be slow to seize upon the thought that it is now possible to direct this reaction and so make evolution a conscious process. Do you see that manual training attempts to do precisely this thing—to create a definite bodily environment in order to bring about definite spiritual results? Nor need I point out again how absolutely such a scheme is dependent for its justification upon our philosophy, how

utterly false it must be if the spirit of man is one thing and his body another.

But the end of evolution is a moral end, and education, evolution made conscious, is also moral. The series of mental reactions brought about by the succession of bodily acts undertaken by manual training has a definite moral end. If the most evolved conduct is, as we have tried to show that it is, that which leads to the fullest measure of happiness for one's self and for one's fellows, and if morality, the art of right living, or right conduct, consists in the realization of the means of happiness, the end of the educational process is no less clear. It must be an attempt to lead man out of a narrow existence, poor in experience, in sensation, in thought, in feeling—poor, that is to say, in happiness—into a broader and more complete life, rich where the other is poor, rich in experience, in sensation, in thought, in feeling; that is to say, rich in happiness. Now, manual training is just such an attempt, and it has just such a warm, human end. It is an attempt through a succession of bodily acts to bring about a series of mental reactions of a definite, happiness-producing kind.

The exercise of every faculty short of the point of fatigue brings a strengthening of that faculty. Every demand upon the skill, judgment, and accuracy means a building up of those qualities, and this increase of power brings an increase of interest. We like to do what we do well. It is this development of a many-sided interest that enriches life and makes each day a welcome experience. It is loss of interest that makes the tragedy of old age. What a spiritual abyss is represented by the men and women who are killing time! The mental reactions of well-planned bodily work make for power, and for that power which leads to the complete full measure of life. Not only is the instrument itself, the brain, made more sensitive by this play of activity, but its power has more to work upon. An enlarged world of experience and sensation makes possible an enlarged world of thought. The effect is cumulative.

Manual training, believe me, is not practically or theoretically a scheme to merely train the hands, to make boys useful about the house, to supply the world with artisans, to take the place of a dead apprentice system, or to meet in education the demands of an industrial age. It has no such special and technical end. Its true end is the major end, the attainment of the complete life, the unfolding and the perfecting of the human spirit; and this end it proposes to gain by recognizing to the full the principle of cause and effect, and by setting into operation agencies adequate to bring about such large results. These agencies are organic. They have to do with the person of the child. Such work can not be exterior. It must be

done in the blood and the tissue. It means literally a change of structure, a new birth, a refining and sensitizing of the organism, a nicer adjustment of the bodily powers. It is only by such thoroughgoing practical work that the process of education can be carried out and the ethical ideal realized.

Nor must we forget that while this ethical ideal has to do solely with the individual, it has equally to do with every individual, and so becomes a social ideal. The full measure of life and happiness which we have in mind as the educational goal can only be attained when each individual life is full to the brim. But the results are never mass results. They are purely individual results. There are moments in life—moments to be remembered—when a whole group of men is stirred by a common sentiment, joy or sorrow, fear or anger, applause or condemnation, and one seems to feel the pulse beat of the whole, and to stand in the presence of something larger and more beautiful than the individual life. But this social organism, of which we seem to catch a glimpse, is at best a mirage, and when followed leads one further and further into the desert. It is true that the mass results which make this vivid appeal to the imagination are due to the multitude of men, but their *quality*, the thing that gave them value, is inseparable from the individual. The new education has always in mind this large social ideal, but it is a practical process and must proceed individually. It gains the social end by the very emphasis it places on individuality. The complete man, strong in his bodily powers, keen in his intellect, warm in his affections, sees in his own personality something very beautiful and very sacred, and comes increasingly to respect the personality of others.

I have tried to present the philosophy of manual training. Let me sum it up. It rests upon a belief in the unity of man. It creates a definite environment for the bringing about of definite moral and æsthetic results. It has for its ethical ideal the complete life of the individual. It has for its social ideal the complete life of every individual. In a word, it is monistic, evolutionary, individualistic, social. Believe me, it is a human movement, directed to human ends, and warm with the best sentiment and best aspiration of the human heart.

EVERY family, Prof. L. H. Bailey says in his Garden-making, can have a garden. If there is not a foot of land, there are porches or windows; and "one plant in a tin can may be a more helpful and inspiring garden to some mind than a whole acre of lawn and flowers may be to another. The satisfaction of a garden does not depend upon the area nor, happily, upon the cost or rarity of the plants. It depends upon the temper of the person."

A CRUISE AMONG HAIDA AND TLINGIT VILLAGES ABOUT DIXON'S ENTRANCE.*

By GEORGE A. DORSEY, Ph. D.,
FIELD COLUMBIAN MUSEUM, CHICAGO.

ON May 11th of this year, accompanied by Mr. E. P. Allen, the museum photographer, I left Chicago for a four months' tour among the Indians of the far West. The object of the journey was to secure material for the Department of Anthropology, more especially to get such objects as could be worked into groups to illustrate the culture history of the Western Indians, and also to secure material to represent the physical characteristics of certain of these races.

Between Chicago and the Pacific coast we visited three great families of Indians: the Blackfeet of Montana and Canada, the Flatheads of Montana, and the Kootenays of British Columbia and Idaho. When we reached Victoria, on June 19th, we had before us two groups of Indians on the northwest coast to visit—the Haidas and the Tsimshians.

As may be seen on an ethnographical map of the Northwest, the Haidas and Tsimshians are only two of five great stocks which are to be found on this coast. Beginning with the north are the Tlingits, who occupy the islands and coast of southern Alaska. Just to the south come the Haidas, who live on Dall and the Prince of Wales Islands of Alaska and the Queen Charlotte Islands of British Columbia. Next come the Tsimshians of the Nass and Skeena Rivers and the neighboring coast and islands. Below them are the Kwakiutls, inhabiting the coast from Gardiner Channel to Cape Mudge on the mainland and the west coast of Vancouver Island. The fifth and last group is the Salish, inhabiting the eastern half of Vancouver Island, the southwestern corner of the mainland of British Columbia, and parts of Washington, Idaho, and Montana.

It is not an easy matter to reach the Queen Charlotte Islands. The Victoria steamers touch at the town of Skidegate once a month, but remain for a few hours only, and the facilities for getting away from Skidegate are limited to Indian canoes. Furthermore, Skidegate and vicinity have been pretty thoroughly investigated by anthropologists, and we were especially desirous of visiting Masset, a remote Haida village on the northern shore of Graham Island, the largest of the Queen Charlotte group. This village is visited by steamers but once or twice a year, when the supplies are taken over

* From a lecture delivered in the Field Columbian Museum, November 6, 1897.

for the Hudson Bay Company's post. We finally decided to take one of the British Columbia steamers, and land at Port Simpson, the chief town of the north coast and the one nearest to Masset. There we hoped it would be possible to secure some sort of a sailing vessel with which we could make our proposed journey.

After eight days of steaming along that most wonderful of inland seas we landed at Port Simpson, six hundred miles from Victoria, on June 30th. The prospect, after a few hours' survey of the barren beach and of the bay devoid of boats, was not cheerful; nor

STREET IN MASSET. Queen Charlotte Islands.

did the perpetual patter of the rain, nor the thick depressing fog, nor the forlorn, deserted appearance of the town, contribute greatly to encourage a belief that our mission was to be successful. One thing, however, was in our favor: the Hudson Bay officer from Masset was in Simpson and was ready to return to his post. This fact, in the end, proved greatly to our advantage, for by his efforts we were enabled to secure one of the boats which had been used by the Canadian surveyors in running the international boundary line in 1895. So the Janet, the largest of the boats, was taken out of the shed and put into the water, and after two days' soaking it was found that the leakage could easily be kept in check, and she was pronounced seaworthy.

Our party numbered five: Mr. Stephens, the merchant; Mr.

Chapman, our skipper; Mr. Deans, our guide; Mr. Allen, and myself.

Upon looking at a map of this region it would seem that the voyage from Port Simpson to Masset ought to be made with no difficulty, but Masset is almost seventy miles due west from Port Simpson, and the prevailing wind hereabout is from the west, and it blows with such force and persistency that Masset must be reached in a roundabout way. Long experience has taught that it is best not to attempt to make a direct passage, and that time is saved by sailing from one island to another along southern Alaska until Point Chacon or even Cape Muzon is gained. From either of these two points Masset is reached usually with but little difficulty. Another reason in favor of this circuitous route is the fact that out from the northeast corner of Graham Island projects a long sand bar, many miles in extent and known as Rose Spit. Over this long, low-lying reef the water breaks with great fury and the tide currents are almost irresistible. Rose Spit is the terror of the Northwest coast, and many are the schooners and canoes which have met an untimely end on its treacherous sands.

All this we knew when we set forth from Simpson at noon on July 3d, but little did we realize what all this meant. There certainly was nothing auspicious in our departure, as we started forth in the midst of a fog and drizzling rain, and after six hours we had only made North Dundas Island, not more than fifteen miles from Simpson. But, notwithstanding the fickle wind and the drizzling rain, the evening and night were happily spent. We had left behind us steamships and towns and civilization, conventionalism and restraint; we were now fairly out of the world. We were to see no boat but our own, nor a living being save at Masset.

On the following morning we were to make our first acquaintance with a specimen of the tides of this region. An early start had been our plan and our hope, and to this end we had our boat loaded, were all aboard, had one sail up, and were ready to push off, but the Janet wouldn't push. When a tide has to fall twenty-two feet within two hours it can't afford to lose any time, and consequently it did not wait for us, and the Janet was hard aground and firm as a rock, and so we waited for the turn of the tide; we waited just five hours.

On account of this mishap the best we could do that day was to make Cape Fox, but that was not without some compensation, for we thus spent the night of July 4th on Alaskan soil. By two o'clock on the following day we had gained Cape Northumberland and were snugly anchored in a cove on Kelp Island. The weather now was all that we could possibly wish, the sky was as clear as crystal, and far

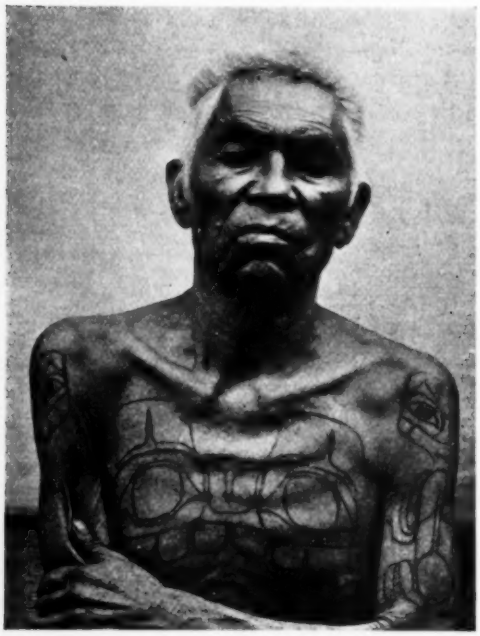
away on the mainland to the east we could see the sun glistening on the myriad ice-bound peaks of the coast mountains, while about us in every direction were the forest-covered tops of half-submerged mountain peaks which make up this sea of islands. The afternoon was one long to be remembered. Tents, blankets, and clothing were put out to dry, while we rambled through the forest, following paths made by deer and bear down to the springs near our camp. The forests were a revelation—bathed in an almost eternal mist which

HAIDA WOMAN OF MASSET WEAVING A BASKET.

has been tempered by the mild Japan ocean currents, they are indescribably green. Giant cedars, firs, spruce, and hemlock fairly crowd each other and leave but scant room for the ferns and underbrush which cover every inch of ground. Then there is a ruggedness about the shores of the islands; here absolutely barren, there piled high with drift, often to a height of sixty feet or more, which speaks eloquently for the mighty forces of Nature which never tire.

We left Cape Northumberland at three o'clock on the morning of July 6th, just as the sun was beginning to throw a ruddy glow over the ice-bound peaks on the mainland. By eleven o'clock we

had rounded Devil's Rock, upon which the ill-fated Mexico was to strike only a few days later. At one o'clock we were within sight of Tow Hill, the most prominent point of the northeast shore of Graham Island. And then the wind veered to the west again. Harder and harder it blew until the sea was lashed into white foam. For twenty-six hours we beat in the face of that wind, now gaining a little to the west, now carried toward Rose Spit by a current which seemed stronger than the gale, and now so close to the shore that we could all too plainly hear the roar of the surf as it broke upon the rocks. Drenched to the skin, the waves breaking over us every few minutes, the air filled with spray, our boat half full of water at times, we passed twenty-six hours of wretchedness, misery, and abject fear. At times we were only a few feet from waves which, had they broken a little nearer, would have filled our boat and lowered us away to the bottom of the sea.

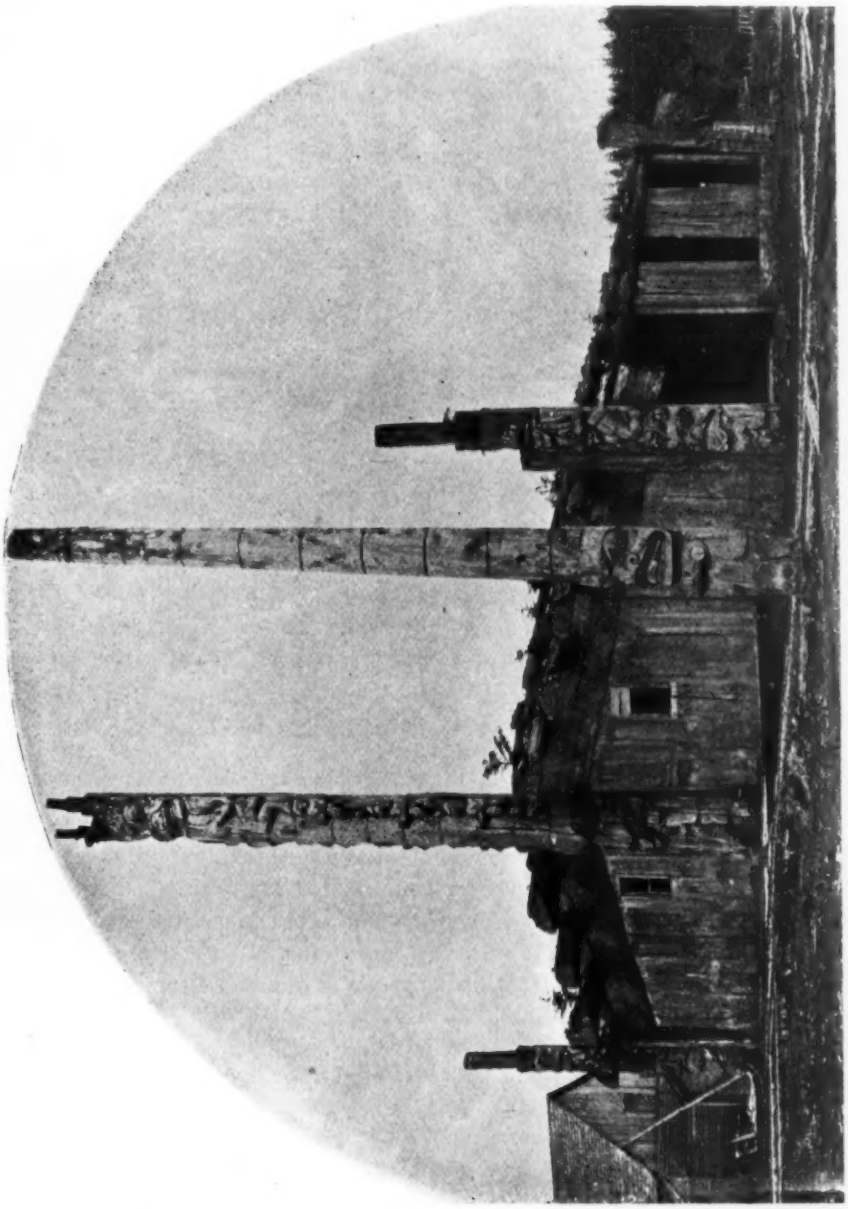


A Tattooed Haida of Masset.

On the following afternoon we began to put miles between our boat and Tow Hill, and were nearing the mouth of Masset Inlet. With one more tack we have rounded the point and are headed due south, and a favorable tide bears us rapidly down the inlet; a minute more and we sight Masset—a strange, quaint little sleepy village, with its tall totem poles and row of cottages.

Masset is one of the two villages which to-day make up all that is left of the Haida nation on the Queen Charlotte Islands. The Haidas numbered seven thousand in 1840, and counted over thirty villages. To-day there are two inhabited villages and less than one thousand Haidas. They are a doomed race. Wars, smallpox, gross immorality, a change from old ways to new ways—their fate is the common fate of the American, whether he sails the sea in the North, gallops over the plain in the West, or sleeps in his hammock in the

forests of Brazil. Masset typifies in itself that process of change and decay which we find going on among the aborigines all over the con-



ANCIENT HOUSE OF CHIEF WEHA. Masset.

tinent. The totem poles drop one by one; the great massive houses of the old times, with their mighty cedar beams, slowly succumb to the wind and the weather; the old grave posts totter and fall,

but their ranks are not filled up. In their stead are little stuffy, propped-up cottages with iron stoves and glass windows, and by the side of this modern village is the marble burying ground with marble columns brought from Victoria. Masset is the Clyde of the coast, and in the fall and winter the little street along the water's edge is lined with great cedar logs, which are being chipped, steamed, pressed, and fashioned into canoes, some over fifty feet long. Strong and well built, the Haidas make journeys in them of hundreds of miles—they are the vikings of the New World. Another important industry of the town consists of weaving cedar bark into mats and baskets. These mats are strong and well made, and serve innumerable purposes, the chief uses being for the floor and for the outside covers of bundles and packages. But their principal utensil for carrying is the white basket made of closely woven splints of maple.

The real interest in Masset, as well as that of other Indian villages of this region, lies in the past; and to the past we turn. Beginning with the ancient customs, we look in vain for the great labret or lip ornament of old, which formerly played such an important part in the fashion in deformity. We did see one woman with a tiny plug in her lip, but from this one can form no estimate of the extent to which this custom was formerly carried. Of the tattooing little remains, for the custom has long since been given up. But the majority of the middle-aged men and women have their arms and legs tattooed; and by dint of much persuasion and a piece of silver we induced a decrepit old man to leave his house long enough to enable us to carry away the photograph of his totem, which was tattooed on his breast.

The physical characteristics of the Haidas are peculiar and are to be explained by the circumstances under which they live. With but little exposure to the sun their complexion is very much lighter than that of the coast tribes, and indeed often for fairness compares very favorably with that of the Europeans. They have a full, broad face, large eyes, a nose rather delicately molded, and prominent cheek bones. The hair is jet black, thick, and heavy. The men usually keep the hair plucked from the face, but where the beard is allowed to grow it is generally thin and scant, and is almost confined to the mustache. With both sexes the hair grows low over the forehead. Twice while in Masset we encountered faces which in their features seemed unusual and out of place. On inquiry we learned that they were both slaves who had been taken in war from the coast Indians long ago.

Owing to their almost constant seafaring life, the Haidas have long and powerfully developed arms, while their legs are propor-

tionately short. A single glance at a Haida walking is sufficient to convince one that he is more at home in a canoe than on the land.

Of the ancient houses in Masset not one remains in good condition. But stately even in its ruins still stands the historic house of old Chief Weha. It is composed of massive beams and walls of great, wide, rough-hewn cedar planks. Its entrance is still guarded by the ever-present totem pole, which is one of the best in the village. The interior is even more interesting than the exterior, for it reveals the massiveness of the timbers and the solidarity of these houses. When one looks upon such a structure as this and compares

A Tlingit Shaman's Grave on Duke Island.

it with the ramshackle cottages of to-day, the feeling forces itself upon one that in this respect as in many others the Haidas have given up the substance for the shadow.

It is sad to relate, but it is true, that the day is not far distant when there will not be a single totem pole in British Columbia. I believe I am safe in saying that another one will never be erected. The old ones do not fall of their own accord as fast as they are cut down; for, strange as it may seem, the natives actually cut down one or more poles every winter for firewood, and in this they are encouraged by the missionaries. The totem pole is a coat of arms, it is an epitome of the owner's mythical ancestry; from its curious conventionalized animals or hieroglyphs we read into the past, of the time of their garden of Eden, and of their struggles and friendships with the monsters of the deep and the creatures of the land and air.

The totem pole stands immediately in front of the dwelling, and in its more ancient form was even an intrinsic part of the house, for an oval opening at the base of the pole served as the entrance.

In addition to the totem poles there was erected in former times an additional pole at one side, near the front of the house, which answered the purpose of a mortuary or memorial column. This pole is usually quite plain, and is surmounted by the crest of the man in whose honor it was erected. Several of these are still standing at Masset, one of the best preserved being the bear column in front of old Chief Edenshaw's house. Farther down the beach we came to another pole which was surmounted by a conical structure which bears a close resemblance to a Haida hat, and, in fact, they relate in Masset that it actually is intended to represent a hat. This pole is not duplicated elsewhere on the Queen Charlotte Islands.

Of the ancient burial columns but two remain standing, the others having been pulled down and the dead buried in the little modern cemetery. The first column is single and stands near the water's edge. On the side facing the village and near to the top a rectangular cavity had been chiseled out within which was placed the box containing the body. The other burial structure is in the form of a double column or two posts, whose tops are united by a hollow, boxlike crossbar. In such burial columns as this were usually placed two or more bodies, and in some even entire families.

More photographs, purchases of relics, and measurements of heads, and we were ready to leave this half-modern, half-barbarian, half-dead, half-alive village, for others which knew neither teacher nor preacher, but which were long since abandoned and given over to solitude, to moss, and cedar trees, to snails and hoarse-throated ravens.

Skirting along the western half of the northern shore of Graham Island, we made our first stop at Yan, about three miles from Masset. Here, as elsewhere, we encountered a luxuriant vegetation which covers every inch of the soil, and even mounts to the top of the burial columns and to the decaying rafters and beams of the great old houses. Probably the most interesting object we saw at Yan was a mortuary column, the crossbar or the coffin-box support of which was of a single board, and most handsomely carved in totemic designs. After pushing and crawling for an hour through wet underbrush, made up largely of salmon and rose bushes over three inches in diameter and from fifteen to twenty feet high, we were off again, and that night, with the friendly assistance of a favorable tide, we dropped down into Virago Sound and anchored in front of the old moss-covered village of Kung. This was one of the best of the old villages along this coast, but is now completely

deserted. We found much to interest us. The totem pole with the moon symbol was the first we had seen, nor is it reproduced elsewhere on the island; but what proved of special interest were several very old graves which faced the beach on the east side of the village. These were the burial places of medicine men or Shamans, and quite different from the ordinary grave. Instead of a single pole in which the body is placed through a hole in the top or at the side, or from the double-pole platform grave which we saw at Kung, we found a little house built of short cedar logs. Inside was placed the Shaman in a long coffin-box, reclining at full length with his

EGG-SHAPED ROCK CONTAINING BURIAL HOUSE OF A HAIDA SHAMAN.

rattles and other ceremonial paraphernalia about him. With one had been placed several very fine masks, but they had almost entirely crumbled into dust. The grave of the old chief at Kung was the best I had seen. Four short, stout posts had been firmly planted in the ground, and on the inner corners of each grooves had been cut out to receive the beams that supported the little house, in which lay the chief in state. The structure was nearly buried in a thick growth of vegetation, and much work with the axe was needed before the beautifully carved posts could be rendered visible to the camera.

Leaving Kung at ten o'clock in the morning, we set out for the extreme northwestern shore of the island, and that night anchored in a little cove on North Island. We were now on deserted but

historic ground, for it was here in 1787 that Dixon first traded with the Haidas, and in one day secured over three hundred sea-otter skins, which to-day are so extremely precious. This was the opening of the fur trade on the Northwest coast, and from this memorable day's trade sprang up a commerce in furs which has continued down to the present time.

Fortunately for us, one of the old houses had been re-roofed by some previous visitor, and so we found within dry cedar planks upon which to spread our blankets for the night.

On the following morning we crossed over to the old village of Kiooste, where there is much of interest; but the place is so over-

GRAVE OF A HAIDA CHIEF. Queen Charlotte Islands.

grown with underbrush that it was only with the greatest difficulty that we could get from one house to another. Recrossing the strait to North Island and anchoring our boat to a piece of kelp, we explored the little egg-shaped rock of Gorgie Sethlingun Nah, or Gorgie's Coffin House. Gorgie was a famous Shaman of Kiooste, and when he died was laid to rest in a handsome little house on the summit of this island. By much hard work we were able to reach the top of the rock, but the house had tumbled into ruin, and two hats were all that remained to tell of the former glory of Gorgie.

Next day we explored the cave of Skungonah. Skungonah was a hermit who lived over a hundred years ago and dwelt here alone,

living on raw fish and birds. But in after years the great cave became the burial ground of Kiooste.

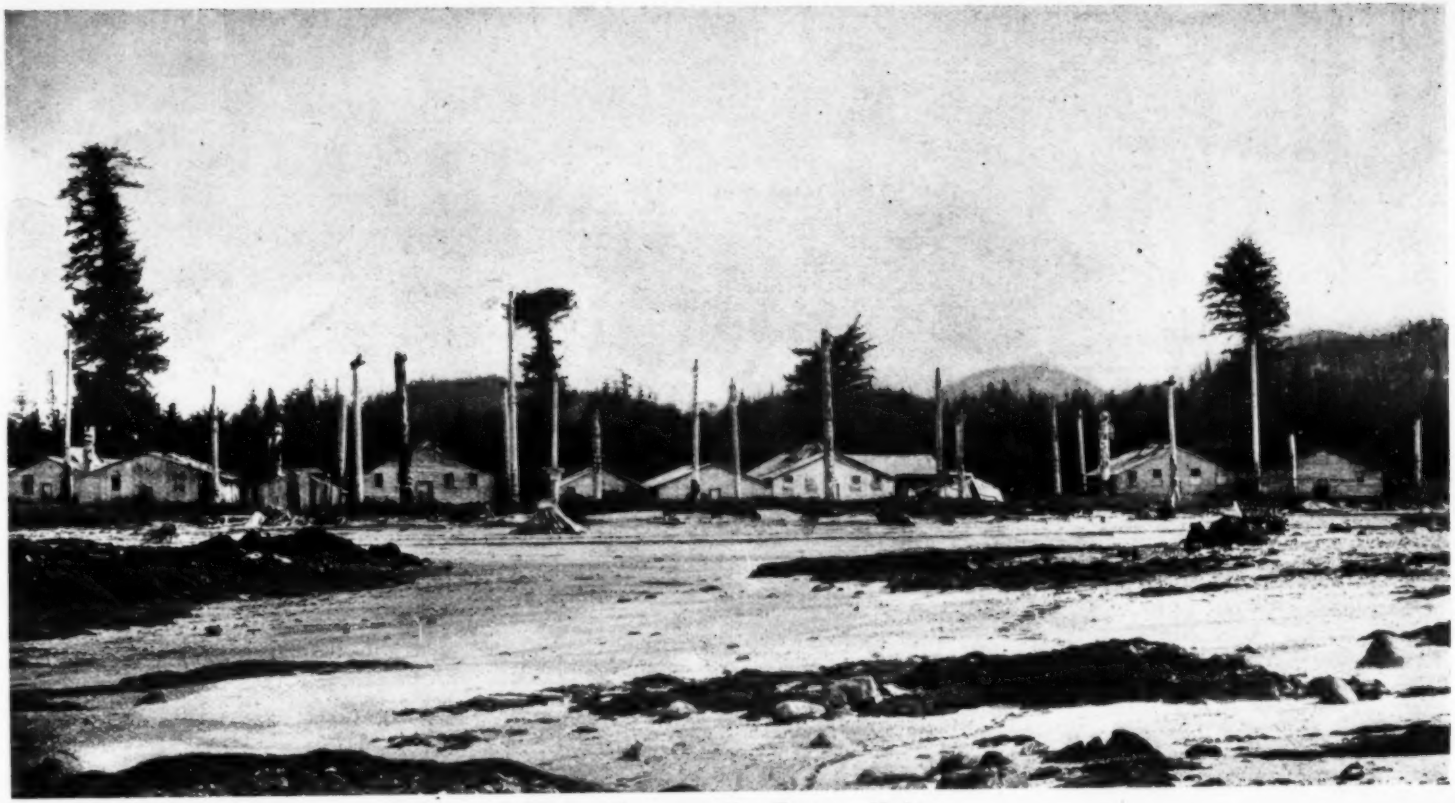
We were now obliged to return to Masset for provisions. Leaving Masset at half past ten in the morning, we entered the harbor of Old Tongas at half past nine the same night, having made eighty miles in eleven hours.

We were now in the country of the Tlingits, and before us was Old Tongas—old because it was long since abandoned, and its inhabitants had formed another or New Tongas. Tongas is the southernmost of a chain of Tlingit villages which extends as far north as the Aleutian Islands. Like the Haidas, the Tlingits are slowly but surely disappearing, and the time must soon come when the race will be entirely extinct.

There is but little of interest to-day in Old Tongas except the totem poles and the old ruined houses. Totems with the Tlingits play the same important part in their civil and religious life that they do among the Haidas. Even the corner posts of their houses are carved into totemic designs. Comparing their totem poles and memorial columns with those which we saw in the Haida villages, it becomes apparent at once that the symbols are more boldly executed and the conventionalism less pronounced. The figures are not blended and combined as they are among the Haidas. We noticed also that the human figure is repeated over and over again, and is always portrayed with a boldness and fidelity that are worthy of the highest praise.

One of the unique features of Old Tongas, and one we saw nowhere else, was the ruin of a house which still retained its old front porch made up of heavy logs; while in front, leading up to the porch, was a pair of primitive steps hewn out of a solid log. In another place, almost entirely obscured by vegetation, we came upon a recent house grave surmounted by a cross, showing that the influence of missionaries had been felt here before the town was deserted.

At ten o'clock we started toward the east again. We had been disappointed in not finding the grave of a Shaman or medicine man. It is no easy matter to secure osteological material from the Tlingits, for until within a very few years the dead were cremated. This rule, however, did not apply to the Shamans, for it was believed that their bodies would not burn, and consequently they were placed in little house graves usually erected upon some lonely rock or picturesque promontory. We had been slowly working away at the oars, for the wind had completely died away, and were rounding a point on Duke Island, when we espied one of these little houses perched far up on a rocky point which was piled high with innumerable drift. We were soon ashore with the camera and found our-



TLINGIT VILLAGE OF NEW TONGAS. Alaska.

selves well repaid for our pains. The house was about thirty years old, and its roof was covered with a thick growth of moss. It was about five feet high and nearly six feet square. Removing a portion of one of the walls, we could see the body, which had been carefully wrapped in several cedar-bark mats, and tied into a neat bundle with stout cedar-bark rope. Over the bundle were branches of bog myrtle, and under the head was a box. Removing the wrapping still further, we disclosed the desiccated body of a woman doctor. In one hand she clasped a long knife, its steel blade entirely wasted away, leaving only the handle. In the other hand was a beautifully carved wooden pipe inlaid with finely polished abalone shells; but her real title to distinction lay in the immense wooden plug or labret which still remained in her lower lip. Throughout the entire Northwest coast the labret was a mark of honor, and the larger its size the more honor it conferred, for every time a new labret of larger size was inserted it necessitated the giving of a great potlatch, or present-distributing feast. It is related that in the olden times disputes between women were often settled by one of the disputants, scornfully pointing one hand at her enemies and laying a finger on her own labret, declaiming in a manner at once emphatic and conclusive, "My labret is bigger than yours."

Our next stopping place was New Tongas, which we reached at six o'clock on the following afternoon. We were soon ashore, but our expectations were not fulfilled, for in this town of *New* Tongas there was not a single living soul; all were away at work in the salmon canneries.

The location of the town is most delightful. It stands on a little island facing a long, rocky beach. At the rear of the village is a dense forest of cedars, pines, and spruces. The architecture displayed in the houses is not of the usual white man's cottage order, but the plans of the old times have been followed, so that the houses bear a superficial resemblance to their former dwellings. In the place of massive beams and three or four foot cedar planks, however, are light frames and thin, narrow weather-boards. Most of the houses have two or more windows, which are often boarded up and are generally without glass.

In still another respect this modern village has preserved one of the old-time features of house building. We looked in vain for any chimney, but found instead a square opening in the center of the roof, partially covered over, through which the smoke makes its exit. Of the many interesting totem poles two may be noticed particularly. The first stands by the side of the present chief's house, and has been erected within a few years. The designs are well made and of an unusual character. The other totem pole is one of

the largest in Alaska, and was put up during the life of Ebbits, a Tongas chief who was named in honor of one of John Jacob Astor's captains. A tablet near by reads:

"TO THE MEMORY OF EBBITS,
HEAD CHIEF OF THE TONGAS,
WHO DIED IN 1880, AGED 100 YEARS."

At one o'clock we started for Simpson. The run of twelve miles was made in about two hours, and within less than half a day's time we were aboard the magnificent steamer Islander, bound for Port Essington.

ASPECTS OF NATURE IN THE AFRICAN SAHARA. A SUMMER JOURNEY.

By Professor ANGELO HEILPRIN.

II.

MORE than one traveler has remarked that the most important lesson that traveling teaches is to unlearn that which has been learned before. No matter how seemingly truthful a picture may be, how carefully worded a description is, somehow or other the actual fact rebels against the conception which has been brought to the mind. The great African desert repeated the lesson that was taught to me a few years before by the icy wilderness of the far North, and still earlier by the primeval fastnesses of the tropics. Is it that the description of a new country is so difficult a task, or that the narrator intentionally beguiles himself into an excess of imagination, which makes the telling or the conveying of the simple truth so seemingly impossible? The late Professor Drummond, in his work on Tropical Africa, ventured to lift the veil from the picture that had generally been drawn of the dark continent, and assumed to disenchant the reader of preconceived notions regarding vast and impenetrable primeval forests, of gayly plumaged birds, of monkeys swinging from trapezes in shaded bowers, etc. But for this mendacious effort to destroy an old picture and to reconstruct a new one he was sharply taken to task by Mr. Stanley, who averred that the true picture of Africa as drawn by Professor Drummond bore "no more resemblance to tropical Africa than the tors of Devon, or the moors of Yorkshire, or the downs of Dover represent the smiling scenes of England, of leafy Warwickshire, the gardens of Kent, and the glorious vales of the isle." In short,

Nyassaland, the region traversed by the talented divine, is represented to be not Africa, but itself. And yet in another part of great Africa a more recent traveler, Mr. James Johnston, the author of a remarkable work entitled Reality *versus* Romance in South Central Africa, assures his readers that he "traveled four thousand five hundred miles, mostly on foot, and alone so far as a white companion is concerned, passing through numerous hostile and savage tribes, traversing areas hitherto reported too pestilential for exploration, surmounting natural objects which have been represented as insurmountable, and penetrating regions where no white man had ever gone before," and during this performance he never once found

A Caravan on its March.

himself prompted to fire a shot in anger, nor was he compelled to do so in self-defense against a human enemy.

With a feeling that my words will carry little weight with those who think otherwise, I venture to suggest that the Sahara is not exactly what it is commonly assumed to be; and yet in many ways it is not very different. Its first sands, when approached from the side of El-Kantara, are giant rocks, burned brown and red under the glow of the southern sun, standing out in wild pinnacles from the gently undulating surface. This is not the desert that is ordinarily pictured by the mind—that flat, endless expanse which fades off unmoved and unbroken to the limits of vision—but it is the desert, nevertheless, just as much as the mountain snows of the far North

are a part of the great arctic "sea of ice." Beyond, however, is the great plain itself, its swelling undulations hardly relieving to the eye the appearance of absolute flatness which the picture offers. The truth is, the Sahara presents itself in a double aspect: that of the flat and sandy plain and that of the rocky ridge or mountain, the Hammada. It is the Hammada that is more particularly dreaded by the caravans, for among their wind-swept crags there are few oases, and only the blowing sands and a relentless sun are the companions of the foot-sore pilgrim. In many parts of the flat desert traveling is moderately easy, for over long distances the surface has become coated into a hard, slimy crust—a solid basement rock, one may call it. Along our route of travel there were no sand dunes of any magnitude, the highest perhaps scarcely exceeding fifteen or twenty feet, but I was informed by the distinguished French explorer M. Foureaud, who was then stopping at Biskra, that beyond Tuggurt they rise to the prodigious height of from twelve hundred to fourteen hundred feet. This speaks even more eloquently for the power of the winds than do the high-tossed sands of coral islands.

It has become customary of late with certain text-books to state that the Sahara is not so flat as it is commonly assumed to be, and that it is almost everywhere torn into ridges and rents. This is, however, an imperfect statement of the truth. The flat desert is almost interminably flat for days or even weeks of travel, with hardly a rise of a few feet for mile after mile of perspective. In vain the eye searches after some special object to give it relief; it does not find it, unless it be the far-off tufts of an approaching oasis. Often has the desert been compared with the sea, but probably to most persons such a comparison, except where it stands for magnitude, will be considered extreme. It is true that where the surface is illumined by the weird light of the mirage it may depict the presence of water with startling naturalness, but the deception belongs rather to the atmosphere carried by the desert than to the desert itself. I am not sure that these endless sands are truly imposing; wearisome they certainly are, but at times they present most exquisite pictures in the varying lights of the morning and evening sun. It is then that they seem to constitute a world of their own, speaking in color that belongs to them alone. We were not to any extent troubled by their presence, either as an impediment to travel or as freely floating discomforts in the atmosphere.

The journey which I had projected took the course of the great caravan route to Lake Tchad, passing by the deep depression which is occupied by the largest *chotts* of the desert, the possible reclamation of which by the Mediterranean has been the subject of much study on the part of French engineers—the dream and hope of M.

Roudaire. The road—for such the tread of the caravans may properly be called in this part—follows out the full north-and-south extent of Biskra, and almost immediately after leaving the last palm of the oasis enters upon that vast expanse of sand which, with the little green that belongs to it, constitutes the southern panorama. Being limited in time, we did not avail ourselves of the facilities of travel which the caravans afford—nor, in fact, did we feel disposed in a first effort to submit to the disarticulating motion of the dromedary—but arranged for a small cabriolet and two teams of horses, to carry us so far as this improved form of conveyance would permit. To insure a speedy journey, I had ordered one trio of horses to proceed in advance to Chegga, some thirty miles distant, there to await our coming on the following day. The morrow, however, was not to be as we had planned, and here again we took in a new lesson in physical geography. At the evening meal at Biskra information came to us that the relay of horses which had been ordered to our advance post had returned, not having been able to make the passage of the Djedi, the main waterway of southern Algeria. The course of this stream, when it exists at all, is directed southeastward into the depression of the Chott Melghigh, where its waters add still further to the accumulation of salt, which now lies some fifty to sixty feet below the surface of the Mediterranean. Ordinarily it offers no impediment to a passage, but now—and in the dry season—it had suddenly expanded to the dimensions of a lake, burying the surrounding country for miles beyond its legitimate banks. This was strange news, for who would have suspected a journey into the Sahara to be interfered with by an obstacle of this kind at this season of the year? The overflow of the Djedi was the result of a mountain storm which had preceded by three or four days, and only now had the waters expanded to their full volume. The Arabs had vainly attempted to force our horses across, and what they can not accomplish in this direction might safely be left untried; but we were informed that there would be a great *abaissement* of the waters in the next twenty-four hours, and that the relay would successfully pass in that time. Complacently, even though regretfully, we acceded to this forced delay, but we remained not a little suspicious as to the promised lowering of the waters. Pending the making of new arrangements occasional flashes of lightning broke through the western sky, and the raindrops pattered heavily on the great palm tufts that reared their heads over the garden court of our hotel. It was showering, and pleasant interludes were given over to sprinkling of hail. At another time, as students of geographical text-books and of special guides, we should have been surprised by the conditions as they presented themselves to us, but we had already been

inducted into the mysteries of contradiction by the heavy rain which, on the day following our arrival (August 28th), had washed out the streets of Algiers, and by the storm which a few days later broke upon us in our crossing of the Djurjura Mountains. The fact is, as our charming hostess informed us, heavy showers are in this region by no means a rare occurrence, even at this season of the year.

Promptly on the morning of September 7th, when the oasis had yet hardly awakened to the call of dawn, we found our cabriolet waiting for us, its three sorry-looking horses bowed down to the work that had been prepared for them. A stalwart semi-Arab, uniformed in the white garb which is thought best to ward off the heat of the desert sun, stood for our driver, and it was fortunate for us that his linguistic attainments covered the French language as well as his native tongue. Like many of his tribe, he had accepted the language of his conquerors; but, again, like others, although without any good reason that he had to give, he was not disposed to look placidly upon the continuous march of civilization which the French had inaugurated. Being young in years, the good old times were merely a tradition with him—a tradition not in itself sufficient to warm enthusiasm within his breast, nor to eradicate that germ of laziness which had taken possession of his body. Ben-Sali was at times excruciatingly lazy, although at the start he served us and himself about equally well; later in the day, when the monotony of his work began to assert itself, and when the desert heat had almost continuously forced from his brow huge beads of perspiration, he withdrew to silent meditation and to the enjoyment of a lone pipe—at intervals goading on his horses to better work, at other times roundly berating them for their shortcomings. Poor animals! they had a hard work before them and accomplished it well, but they received no consideration from their driver.

The early start, giving us the better part of four hours before the sun succeeded in dissipating the banks of clouds which veiled the eastern sky, made the first part of our journey truly delightful. There was no desert heat to be distinguished from any other form of heat, and if anything, the morning could be more nearly called cool than warm—at least, so the outdoor air appeared compared with the confined atmosphere of our hotel rooms. Driving into the Sahara may appear strange to those whose only conception of the desert is based upon the old notion that it is an almost endless expanse of soft and shifting sand and nothing else. But drive in one readily can, and even behind a trio of horses whose vigor and strength were less marked than they were in our own animals. The roadway was fairly marked out for most of its course, appearing at times as the solid basement rock of the region, while elsewhere it

was constructed of a firm setting of gravel and sand; only at rare intervals did it bury itself beneath an extensive sand covering, and even then it emerged, as clearly marked as before, to continue farther into the interior. The caravans have trod the line firmly, and their trail is a broad, open road; but the French have given stronger contour to its outlines by planting one hundred and seventy miles of telegraph poles, and to-day the service is being conducted still farther, to beyond Ouargla. The Arab chief, except in so far as he may be the leader of a caravan, has virtually disappeared from this section of the route; but at two or three days' journey the Tuaregs and other wandering tribes, to whom tribute is paid at the point of the spear, hold almost undisputed possession of the desert. It was along this route, considerably beyond Ouargla, that the scientific corps of General Flatters, sent out with a view of examining into the possibilities of railroad construction into the far Sahara, was virtually annihilated; and it is for this same route that the indomitable M. Rolland seems finally to have secured the practical co-operation of his Government toward building the road which has been so long outlined.

Not knowing the exact nature of the country, and least of all the conditions of security which govern traveling in a region so near to that in which unpleasant tragedies had recently been enacted, I applied for a military pass before leaving Algiers, and through a fortunate access to the good-will, in the absence of the governor-general himself, of his representative, Captain Lasson, obtained the following order:

"The French Republic, General Government of Algeria:

"We, the Governor-General of Algeria, beg the civil and military authorities to give aid and protection in case of necessity to Messrs. ..... and ..... traveling to Fort National, Biskra, and Tuggurt.

"By command of the Governor-General, the Captain, Chief of Internal Affairs and of the Military Service. Algiers, August 29, 1896."

While this paper was naturally a very pleasant addition to the "documentaries" with which we had already provided ourselves, as so often proves the case with papers of its kind, there was no occasion to bring it into use—at least, not for the purpose for which it was prepared. We nowhere met with hostile tribes, and at the wayside caravansary—the *Borj*, *Burg*, or fort—received only hospitality and that simple attention which distinguishes the Arab. Humble refreshment, except coffee, is hardly to be obtained here, but the refreshing shade of the large stone building is at the service of the traveler, and it is not often that he is tempted to pass without availing him-

self of its expansive comfort. His animals are destined to fare less pleasantly, inasmuch as they are generally left to dry their bodies in the open sun, with a temperature beating over their heads of possibly not less than 130° to 140° F. This habit of denying to the animals what little comfort was to be had was a trait painfully apparent in our driver, but it could be said in his behalf that he differed in this respect little from other members of his tribe. What special object he had in allowing his jaded horses to wilt under a burning sun, when a few feet approach would have brought them a generous temperature thirty degrees lower, could not be ascertained.

Saada, whose position on a bank slightly elevated above the Djedi saved it from the recent overflows, is one, sufficiently typical

OUR WAGON PLOWING THROUGH SAHARA MUD.

in itself, of a series of caravansaries which are scattered at intervals through the northern Sahara. A large quadrangular space, intended to accommodate a goodly assemblage of men and animals, is surrounded by a stoutly built wall of masonry, the inner side of which is variously subdivided into rooms and stalls, yielding clean shelter joined to a refreshing shade. Entrance is by a single gate, closure of which means the guarantee of safety to those in the interior. The whole is under the military administration of a handful of leisure-loving Arabs, who look to the wants of the traveling caravans, and presumably as much to their safety as to their comfort. Long before reaching Saada the effects of the late storm had made themselves disagreeably apparent. The road, or what there was to represent it, was washed into gullies by the recent overflow,

and our wheels sank deep into the mire. The mud of the bottom valleys of our Western rivers would have been considered a feeble circumstance compared with this mud of the presumably dry Sahara. Side backwaters added still further to our difficulties, and for a time it looked as though we should hardly pull through; but with enough of "ee-yups" and "ees," joined to the cracking of the great whip, we finally reached the actual bank of the stream and were there helped across by an Arab who had come down from the caravansary to guide the horses. The river was running fast, turbid with yellow sediment, but it had contracted itself to its legitimate channel. We pulled up to the great portal of the *Borj* for our first halt, and immediately received the hospitality of the place—which meant stools to sit upon, in place of the gravelly earth, and the supporting back wall, of which the Arabs make such good use. We had hardly hoped to obtain refreshments here, as Ben-Sali had informed us that such would not be dispensed to travelers, but I ventured to ask for coffee, and in a short time we were served with the delicious beverage, prepared with that same consummate skill which is the art of native coffee-making in the north of Africa, and with the daintiest of foreign china. What changes in the civilization of the world are in progress!

Beyond Saada the road changes much for the better, and we kept the animals going at a lively pace. On either side was the gently undulating and hummocky sand, crowned by terebinth bushes and salsolaceous scrub, high enough to conceal the straying goats that were in places browsing upon them for their scant vegetation, and everywhere sufficiently dreary elements in the landscape. Two forlorn trees or treelets, seemingly olives, were left by the roadside, and the undulating plain, with its closely oppressed horizon, kept on for mile upon mile in its monotonous sweep. Despite its dreary and forlorn aspect, it had for us its attractions; its peculiar sterility—one can hardly say absolute barrenness—and uniformity were, if nothing more, inviting to study, and my mind frequently wandered forth in an almost wild contemplation of the scene. Our cabriolet was well suited to the special purposes of our explorations, as we could easily dismount for the examination of specimens, and even with a high temperature there was no special inconvenience in this. There was, however, little need to leave our seats, as, conformably with the landscape and the general character of the country, there was a marked uniformity in the geological and botanical features as well; a study of one section meant practically a study of the rest.

So far as the heat of the desert is concerned, it is an unquestionable reality; and yet, perhaps, in the month of our travel, the hot-

test of the North African months, it was not so dreadful as we had anticipated. It is true that the mercury, whether by night or by day, felt little disposed to leave the region of the ninety-eights, unless it was in the direction of an upward journey. During the hours of midday it stubbornly clung to the division line of 110°, passing even beyond it slightly (although, perhaps, not in the most perfect shade); at Biskra, during our brief absence, it stood at 116°. While traveling we were subjected to even a much higher temperature, as at rapidly recurring intervals the heated reflections from the burning sands were blown bodily into us. This temperature was probably not less than 120°, and it was then that we remarked, "This is like an oven." And, in truth, it was very much so. The excessive dryness of the atmosphere doubtless conduced to render it bearable; at least it had the effect of checking excessive perspiration. On the other hand, its extreme quality brings to many a partly suffocating feeling—a feeling as though it were lacking in the proper amount or quality of oxygen. The parched palate asks for a moistener, and for repeated lotions in decreasing periods of time. Still, the whole is both bearable and supportable, and the foreigners who have located at Biskra seem to have acclimated themselves in a comparatively short space of time. What surprised me somewhat was the rather slight difference between the temperature of the open and that of the shade, probably not more than twenty degrees; the highest reading that we found was 132° F. The temperature of the sunny sands was at its highest 123°.

By the time we reached the relay at Chegga our horses had become well tired out; the thirty miles had told hard upon them, but, considering the quality of the road and the excessively high temperature, all of it the temperature of the open sun, we did far better than we had reason to hope for. At almost precisely noon we drew up beside the town walls, where the trio of fresh horses was waiting to meet us. An almost hopelessly dismal lunch, to which the distinctive flavor was given by bottled lemonade heated in the sun, prepared us for the further journey, and at one o'clock we were again *en route*. The surface of the desert now becomes more undulating, and the telegraph poles, marking the elevations and depressions, rise and fall in rapidly recurring intervals. Without these landmarks thrown against the sky it would have been difficult to detect the inequalities of the desert floor, which to many eyes would have appeared to roll off a flat expanse to the horizon. A feature which by its novelty repeatedly impressed itself upon our minds was the vegetation. A moderately green Sahara is certainly not the ordinary conception of the great desert, but thus far, except for very limited stretches, we had not yet passed the limit of vegetable

growth, or even nearly approached it. It is true that the vegetation consists of scattered clumps of bushes, lowly in height and not over-luxuriant in foliage, but their presence is such as to relieve the landscape of the imputation of being a treeless waste. Along almost the entire line of our journey a generous supply of terebinth bushes, one, two, or three feet in height, covered the sand elevations, and with them was a sickly green salsolaceous plant, the exact nature of which I was unable to discover. And if we can fully receive war illustrations recently gathered from the pencil of a staff correspondent, the same feature must be a characteristic of the Sahara about Timbuctoo as well. There are, indeed, a number of spots where the vegetation is even more luxuriant—if a scattering of plants can in any way be called luxuriant—comprising a number of dry herbs, such as the rose of Jericho, which hardly rises a few inches above the surface; on the other hand, there are areas where the vegetation has been completely stamped out, or where it has been buried deep beneath its canopy of sand.

At about four o'clock we entered the depression that is occupied by the great Chott Melghigh. When we first beheld this salt pan from a distance of a few miles it broke upon the landscape with dazzling whiteness. The salt was upon the surface, and the eye failed to distinguish the presence of water. It was like a vast field of immaculate ice thrown into the sands, over which hung the images that were thrust into the sky by the rarely failing mirage. We did not see overturned buildings and trees, or even sheets of water, in these sky pictures; simple blocks of color, glowing in an intense pink illumination, were the expression of the light aberration, and yet they might readily have been taken to represent sections of fortification walls. The reflected images were very much like those which I had watched for hours among the ice of Melville Bay, the same quadrangular blocks cast up to no very great height above the horizon, and seemingly holding no definite relation to any object which was within the field of vision. At one spot only, and that, singularly enough, in the mountainous or broken part of the Sahara, did we see a mirage reflection simulating a body of water, and so true was the deception in this instance that nothing beyond an appeal to the known geography of the region could rid the mind of the false conception that was presented to it. The Chott Melghigh is the largest salt pan of the Sahara, and it occupies a position fifty feet or more below the sea level. It is here that the gifted Roudaire had hoped to bring the waters of the Mediterranean, and to give back to the sea that which once belonged to it. It was while passing this chott that we first experienced the hardship of pulling through the sands. The hollow had accumulated deeply of

the desert, the shifting wind-blown sands, uniting with the sediment discharges of periodically flowing streams, finding here secure and lasting anchorage. Our wagon stuck and our horses stuck, and no ill use of the lash would for a time induce them to budge. Mr. Le Boutillier and I dismounted and applied ourselves to the wheels, but to little purpose. Coaxing, worrying, and pushing, we succeeded in making a few yards at a time, and then dropped to a condition of seemingly hopeless immobility. It really looked for a time as though we should be obliged to remain where we were until

THE PRAYER IN THE DESERT.

assistance picked us up, just when, or of what kind of assistance that was to be, we knew not. The sun had dropped very nearly to the horizon, its long horizontal rays illumining the desert with that wonderful glow of red which nothing but an artist's brush can picture. The whole landscape was suffused with mellow light, to the pure harmony of which was added the quiet of an almost absolute silence. No bark or howl of a lurking animal, no sound of bird, whether in twitter or song, broke upon the stillness of the evening hour; we alone were the offenders—not, however, with any intent to disturb Nature's slumbers, but merely to extricate ourselves from our uncomfortable position. Between coaxing, pulling, and straining, and a generous trudge through the sand, we succeeded in covering the few miles that lay between us and the next oasis, Mreir. This oasis counts about twenty thousand palms, and, like all others that we had seen, is divided up by garden walls into distinct properties, between which meanders the trodden way of the caravan.

Shortly before eight o'clock the great portal of the *Borj* was opened to receive us, and our first day's journey into that far-off land of the Sahara was brought to a close. We had covered sixty-three miles, more than is ordinarily accomplished in a good day's coaching on American highways.

To sum up a first day's impressions of the African desert is by no means an easy task. The multitude and variety of the scenes that present themselves do not admit of immediate appreciation; nor, perhaps, do they fasten upon the imagination with that intensity which is left by the pictures of other lands. Yet this ruddy Orient is in itself a picture of intensest moods, a lasting conception from which is carried to every mind that is brought in contact with it. The weather-beaten crags, the shifting sands, the sands of unmoving and monotonous silence, the slowly wandering caravans, the long and weirdlike shadows which stalk over the surface in the horizontal light of the rising or setting sun, are all pictures that impress by their individuality; and to these are added others which are hardly less interesting or picturesque in their local color. It is, however, the oasis that is the redeeming pearl of the desert. No poetic temperament is needed to prepare one for the enjoyment of its coming. From miles of distance the eye fastens itself upon the tree tops; the dark green is a break in the landscape, and like the black shadow of clouds it seems to go and come, the gentle undulations of the desert throwing it now and again out of sight. We had penetrated but a moderate distance into the desert, but the coming of the oasis was a relief that can hardly be described—those dense groves of date palms and the circulating streams of water. What must, indeed, the oasis be to those who have wearily plodded its sands for weeks at a time! When we entered Mreir the sun had just set behind the palm forest, illuminating the sky with that soft African yellow which is the special privilege of the brush of Edouard Frère. The tall tree trunks rose against this in specter shadows of brown, silent monoliths as if rising from a silent grave. A more entrancing scene could hardly be imagined, and yet how different was the picture from that which is ordinarily constructed on the guide line of books and narratives!

With a constant departure from the views of old that one has held, a doubt begins to steal over the accuracy of almost every supposed fact in our treasury of knowledge. Was there not some reason to question the existence of those skeletons—the weary relics of departed life—which have from time immemorial figured as one of the dominant features of the Sahara? We hardly dared entertain a doubt on this point, but yet felt somewhat uneasy in our minds. Our skepticism was of short duration. Its skeletons were there,

bleached to whiteness under the burning sun, and in great part still carrying the dried-up cartilage and muscle which had not yet fully left their support. Here, perhaps, a leg, there a skull, elsewhere the full skeleton—each sadly reading the same history—the

At the "Springs" of the Desert.

attempted passage of the Sahara and the fall by the roadside. In the course of the day we came upon the parts of probably not less than fifty animals, most of them camels; the remains of a few mules and donkeys were added to these, but their scarcity plainly showed

the resisting power of these beasts. Doubtless, many of the remains were ancient, for with the dry climate the decomposition of bone is a slow process; and there are no, or but few, hyenas to do away with the skeletons. The many parts lying about, therefore, hardly give a true value of the casualties of the travelers, inasmuch as they represent an accumulation of disaster reaching probably far back in years. But, such as they are, they are a grim and ghastly spectacle, and one not tending to give cheerful reflections to a leader of a caravan or to his hosts.

[*Concluded.*]

THE PHYSIOLOGY OF STRENGTH AND ENDURANCE.

By WILLIAM LEE HOWARD, M. D.

WHEN we read in the daily newspapers of the collapse of a celebrated athlete, or the breaking down during training of a young aspirant for arenic honors, we naturally surmise that fundamental knowledge of the physiology of the muscular mechanism of the human body is either submerged by the overpowering desire to make a record, or totally absent, among certain trainers and their pupils. The want of such knowledge is the cause of many sad conditions existing to-day among former strong and healthy individuals. A comprehensive idea of the physiology of growth, of the physiologic and chemic relations of strength and endurance to age and condition, would be of great value to the present horde of senile individuals—not senile in years, but senile in vessels and tissues—who strive to make their century runs, as well as to the adolescent whose central nervous system is often permanently injured by overexertion in attempting to make the records placed by carefully trained and intelligent athletes.

The human body is a wonderful piece of mechanism, which not only renews itself constantly, but whose strength and endurance and capacity for more work increase with increased use up to the point at which use becomes abuse. At what time and under what pressure this danger line is reached depends upon the individual. However, the approach to this danger line is governed in all cases by fixed and immutable physiologic laws. The athlete must always bear in mind that the length of time that the muscle cell can continue to work will depend upon the rapidity with which the energy-holding explosive compounds are formed by the cell protoplasm and the waste products are excreted (Howell). In other words, the

capital must not be expended at a greater rate than it can be replaced; if it is expended at a greater rate, fatigue commences, and a continuance of this expenditure results in physical bankruptcy. The muscle is continually undergoing change of material. The minute substances which make up the muscle, and whose very actions keep it alive, are being continually cast off, fresh substances taking their place. The cast-off material is the fatigue poison. Without muscle rest this dead, poisonous detritus can not be replaced fast enough by the new products, and the result is an impoverished capital of potential elements. This does not apply only to the muscle in active use up to this point, but to all muscles of the body.

The energy products of food are delivered up to the muscle by the blood, and this fluid picks up and carries away the cast-off dead substances of the muscle. "If the working muscle has taken material from the blood, this material is lost to all the rest; and if the working muscle has given off to the blood poisonous material, this is added to the other parts" (Lombard; Howell's Physiology). These latter, the fatigue products, are only gradually eliminated from the blood. It will now be recognized that to keep on the right side of the danger line in exercise the muscle must have short intervals of rest. Nature so well understood the proneness of man not to heed advice that she placed the action of one muscle beyond his control. This muscle is so internally constructed and adjusted that it has its regular periods of rest, and only in disorder of the body can its expenditure be raised beyond its means. This muscle, the heart, though making contractions at the rate of seventy-two times a minute, is able to continue its work without fatigue throughout the life of the individual. Each contraction of this muscle is followed by an interval of rest, during which the cells recuperate. Push continually the heart beats to a very rapid rate and we approach the danger point at which the fatigue products can not be replaced by fresh cells; the intervals of rest are not sufficient. The same condition exists in every muscle. It is in the extreme rapid exercise, such as sprinting and certain phases of bicycle racing, that we often see either immediate or ultimate collapse followed by irremediable loss of health.

It should be impressed upon all young persons that during life each member of the body, in the very act of living, produces poison to itself. When this poison accumulates faster than it can be eliminated, which always occurs unless the muscle has an interval of rest, then will come fatigue, which is only another expression for toxic infection. If the muscle is given an interval of rest, so that the cell can give off its waste product to keep pace with the new produc-

tions, the muscle will then liberate energy for a long time. This latter condition is what we call endurance.

The power and endurance of the human machine is limited according to our understanding of the above facts, and also our recognition of its slowness in getting started. Like any other ponderous and intricate machine, the body requires time to get in harmonious working order. The brain, nerves, heart, and skeletal muscles must be given some warning of the work they are expected collectively to perform. Ignorance of this fact has broken down many a young man who aspired to honors on the cinder path. The necessity of getting all the parts of the body slowly in working order is well understood by trainers and jockeys on the race track, as is evidenced by the preliminary "warming up" they give their horses, although it is doubtful if the trainers could give any physiologic reason for this custom.

Of the substances supplied to the muscle by the blood, oxygen is one the want of which is soonest felt. The muscle contains within itself a certain store of oxygen, but one which is by no means equal to the oxidizable substances. The muscle's activity is dependent to a great extent on the character and force of the blood flow through the muscle. It must be clear of the waste products, as well as containing sufficient oxygen to continually keep up a renewal of energy. From what has been said it will readily be seen that the result of a muscular task which an athlete wishes to perform will depend primarily on his muscular bulk and on the condition of these muscles, and the rate at which he expends his capital; the test of his endurance will depend upon the condition of the other parts of his body, and how thoroughly and rapidly they will carry off the quickly formed poisonous products and supply fresh ones.

Nineteen pugilists have died in the ring the last seven years. Not one of these deaths was directly due to the force or severity of the blows struck, but because the fighters were "out of condition." The waste products caused by the rapid muscular work accumulated in their bodies, and, forced to go on with their exertion, they dropped exhausted to death—poisoned by material of their own manufacture. Less attention paid to mere muscular exercise, and more to the condition of the blood and other parts of the human machine, would have brought different results. These facts impressed upon a certain class of athletes would be of great moral and social advantage to the world in general. It means that these individuals must have fresh air to live in, clean skins, good, substantial food, a fixed number of hours for sleeping, and avoidance of stimulants. If it was well understood that no man could go into the exhibition ring, or into any contest requiring physical exertion, unless he could show,

after a careful examination by a competent physician, that his condition would warrant a prolonged and severe muscular effort, the result on the moral and bodily habits of a certain class of young men would be superior to any persuasive or semireligious method that the world has yet premonstrated.

What has been said concerning poisoning by the non-elimination of effete products refers also to the nerves and the brain. As the muscles work faster, so do the central nerve cells which send the stimulating impulses to these muscles. These latter cells become fatigued sooner than the muscles. This is a grand feature of physiologic economy, for, did not this condition exist, the muscle would be worked to an irreparable point. The muscular differences noted in individuals are in reality the difference in the nerve cells, the action of the muscle indicating the activity of the central nervous system. When the muscles are being exercised the nerve cells are being exercised, and the effect of exercise on the nerve cells indirectly determines the muscular activity.

It is the general impression among athletes that exhaustion and "loss of wind" is due to the inability to consume sufficient oxygen and exhale rapidly enough carbon dioxide. When the muscle is moving rapidly and forcibly it is true that it demands more oxygen, and gives off to the blood more carbon dioxide than when at rest. When a man is running as fast as he can make his limbs move he is able to keep up the pace but for a short distance unless, like the hunted hare, he runs to his death. On account of the forced, vigorous, and rapid muscular action in this case, the poisonous materials are thrown into the blood, to be carried to all parts of the body—muscles, nerves, brain. The heart is affected by this poison through the nerve cells controlling that organ; the muscles of respiration are similarly disturbed. The panting, distressed efforts of breathing, sidelong tumbling, anhelation, and final semiconsciousness of the hunted stag or hare are a good example of acute auto-intoxication ending in death. This latter deplorable condition is not unknown among the annals of human strife for athletic honors, even with our present advanced knowledge of physiology.

One of the main "clearing houses" of the body, by which the blood is cleared constantly of all its poison, is the liver. The minute cells of this organ each have their own individual work to perform in transforming the toxic material into harmless substances. The cells of this "clearing house" are delicate little organs, and will not stand abuse.* All habits having a tendency to cause dyspepsia—eating

* Experience and investigation lead the writer to believe periodical inebriety to be a symptom of periodical insanity brought about by the accumulation of toxic substances in

rapidly, eating indigestible food, constant and intemperate use of alcoholic beverages, or excessive use of tobacco—disturb the normal work of the liver. Hence, one of the first aims of the athlete should be to keep this organ in the best possible condition. Any clogging or disturbance of the functional duties of the liver prevents the blood from being in a pure state. All parts of the body will show distressing symptoms of fatigue and exhaustion if the little cells of the liver have become diseased or useless through intemperate living and ignorance of the specific duties belonging to each separate organ of the human body.

The changes which take place in the nerves and brain, the changes in the irritability of the former, and the delicate relations which the latter bears to all forms of muscular work, are of too chemic and technic details to be dealt with in this paper. All forms of violent exercise require that the brain and nervous system should be in assured perfect health; that they possess all their normal attributes.

All neurologists have seen the unfortunate and distressing effects of excessive and violent exercise in persons unfit by training or nature for anything more than moderate exertion. The adolescent, the neurotic, and those who have passed their vigorous days, should exercise only under the advice of a physician. Let those who have entered into the false and foolish idea that "century runs" are an indication of prowess remember the ultimate sad consequences liable to follow in a few years. These misguided individuals should understand that to be an athlete for the time being does not mean that they will be healthy. Athletes are healthy, not because they are athletes, but because healthy individuals are athletes. For the average man past five and forty golf offers the best and safest exercise for the Anglo-Saxon. For those who imagine that this pedestrian and philologic game requires no mental effort, the statement made by a caddie to Professor Sellar will be instructive. When this distinguished Hellenist made his first appearance on the golfing green at St. Andrews, the mature caddie who accompanied him remarked, "Ye may be guid eneugh, professor, at teaching laddies Greek, but gouf needs a heid." *Festina lente* is a good rule in most of the concerns of life; it is absolutely indispensable in physical exercise.

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the body. During this interval of mental and moral lycanthropy alcohol is consumed in large quantities until the poison has been eliminated or counteracted by the alcohol. This condition must not be confused with ordinary drunkenness, or the alcoholic condition exhibited in habitual drinkers. (See Alcohol as a Secondary Factor in Dipsomania, by William Lee Howard, M. D., Medicine, February, March, 1898.)

THE SECRET OF ATAVISM.

By F. L. OSWALD.

THE laws of Nature reveal themselves most plainly in the extremes of their manifestations, and a month ago the remark of an American press correspondent must have called the attention of thousands to a suggestive *curiosum* of hereditary influences.

"This city is decked with voluntary bunting in honor of the Czar," he writes from Wiesbaden; "and it is certainly a remarkable fact that the most amiable of the Romanoffs should be the son of a narrow-minded despot, while whole-souled Kaiser Friedrich, the modern Titus, the idol of his countrymen, was guilty of being the father of the most unpopular prince who perhaps ever succeeded to a hereditary throne."

At first glance the coincidence does look like an altogether exceptional freak of chance, but, on second thought, one is surprised to find the alleged portent recall analogies far too numerous to be classed with the exceptions that confirm a rule.

Peter the Great, a more absolute autocrat than the first Napoleon, was the son of the dawdler Alexis, a puppet in the hands of his tutor Morouzoff, and of favorites of the Buckingham type, a holiday prince not wholly adverse to administrative reforms, but with no more backbone than a man of straw.

Witty, skeptical Frederick the Great, the worshiper of Voltaire and the Muses, a genial host, but a political Iscariot and a shocking husband, was the undoubtedly legitimate son of an illiterate ruffian, a miser and bigot whose only redeeming traits were his conjugal fidelity and his temptation-proof loyalty as a vassal of his Kaiser.

And even slander-mongering Fouché did not question the legitimacy of the Duke of Reichstadt as the son, if not the primogenitus, of the Corsican demigod. The poor youngster, it is true, was saddled with Austrian tutors, selected by the *Cultus Minister*, with no special reference to modern culture; but decided talents would have asserted themselves in spite of such handicaps, and Dr. Hentzen, an intelligent and impartial observer, admits that the young exile was "modest, rather good-natured, but hopelessly indolent and *incurious*—indifferent alike to the marvels of Nature and art. But for a love of good cheer, not always distinguishable from gluttony," he adds, "one might suppose that he was pining away and had turned from earthly to hyperphysical hopes."

Indolent, good-natured, and gluttonous—the son of the man who would "dine on the wing of a chicken, and on that frail support fly through Europe in a cloud of blood and fire!"

It will not do to say that the vital energy of the Corsican Cæsar had exhausted itself in his forty campaigns, and that human prodigies are produced at the expense of the next generation. That explanation is neither irrelevant nor unsupported by facts, but it is inadequate; it would explain a *difference of degree, but fails to account for a difference of kind.* It might suggest the cause of the fact that sons of great men often fall short in their attempts to follow in the footsteps of their sires, but it does not solve the enigma why so many of them should persistently walk in the opposite direction.

Apollo did not differ more from a python than Wolfgang Goethe differed from the sluggish old philistine who coiled himself up in his Frankfort alley-den and hissed venomously at all dissenters from his antediluvian tenets. Carlyle's "dry-as-dust" does not begin to describe the idiosyncrasies of that old dragon; the dust on his soul did not cover lurid hopes or relinquished poetical aspirations; he was prosaic to the very tissue of his mental organism and so pig-headed that he once came near ruining his family by venting his ill humor on the commander of a military garrison who had ventured to express his opinions with the freedom of a privileged guest.

And Goethe's only son was *ein kalter Schleicher*—a frigid dullard, with only one passion, an inordinate fondness for the weed, which his father detested as one of the three chief curses of his existence.

"*Heroum filii noxæ*" was a Latin proverb, "The sons of heroes are public nuisances"; and not one of Charlemagne's sons seems to have possessed a single princely quality; while a little, shriveled-up señor in an owl-castle of the Pyrenees begat that meteor of splendid chivalry, King Henry of Navarre.

Voltaire's father, the notary Arouet, threatened to disinherit his son for preferring poetry to pandects, and avoided religious controversies with the anxiety of a Spanish Hebrew. He never ceased to lament the death of his eldest son, who he had hoped would climb the official ladder to the height of a *procurateur du châtelet*, and died without the least suspicion of having produced a champion destined to reach the pinnacles of intellectual fame and decide the litigation of ages as a procurator of reason *vs.* the powers of darkness.

The zealots who proposed to suppress that champion by a general ostracism of the Christianized world would never have got the consent of Dominie Nelson, of Burnham Thorpe, Norfolk, a happiest of country parsons, but also a meekest. In the little garden adjoining his parsonage he would amuse himself for hours digging up herbs and replanting them with a view to quaint color effects, white on sea-green, or pale yellow on blue, like stars on an azure sky. He was fond of guests, and liked to listen to an exposition of new

theories, but could not be provoked into hot controversies, and missed several chances to assert his claims to preferment rather than run the risks incidental to an antagonism of interests.

And that most non-aggressive of mortals originated the sea-monster Horatio, a more insatiable fire-eater than any of the desperadoes that followed the fortunes of Frundsberg and Skanderbeg. During the siege of Calvi he marched a detachment within a stone's throw of a sea wall, to be on hand for a rush into the first breach, and stood motionless, watching the effects of the cannonade, till a shower of splinters struck him full in the face and knocked out one of his eyes. At Trafalgar he would not even button his overcoat enough to cover the insignia of his rank when the sharpshooters of the Bucentaur began their close-range target practice. "What's the matter, Wheeler—have you got the belly-ache?" he chuckled, when the captain of the deck battery conjured him to notice that five or six musket balls had knocked the splinters out of the mast close over his head. And when the overshot marksmen at last mended their aim, his first exclamation was one of military approval: "That's a good one! By Gotham, they've got me this time!"

"Energies bottled up (*represses*) in one generation are apt to explode in the next," says Chamfort, probably with the allusion to such cases as that of Hamilcar, who had sworn vengeance to Rome and passed his life hungering and thirsting for the opportunity which at last came to his son; or the elder Carlyle, an illiterate orator and amateur controversialist, hampered by the lack of the high-grade tools which education supplied to the author of the Latter-day Pamphlets.

But preacher Nelson experienced no fits of combativeness needing repression in stress of circumstances; he was pacific by instinct, and more averse to controversies than could always be reconciled with the exigencies of his situation.

Jean Jacques Rousseau was the son of a well-to-do artisan, more distinguished by his convivial disposition than by a lurking *penchant* for solitude or social revolt. Mirabeau, *père*, was a miser and bigot of conservatism, sticking to his Provençal country seat like a badger to his den, while his son exhausted his resources in extravaganzas and needed *lettres de cachet* to restrain his roving mania.

That revulsion from avarice to extravagance is, indeed, so frequent a phenomenon that Goethe seemed to consider it the normal result of a niggardly education:

> "Ist der Vater auf Geld versessen,
> Und nützt sogar die Lampen-Schnuppen,
> Kriegen sie dann der Sohn in die Kluppen,
> Gauner und Dirnen werden es fressen."

Mirabeau senior was wealthy enough to roam earth in a coach and four, but preferred his rural retreat; Marcus Aurelius, the philosopher on the throne of the civilized universe, could have found diversion from the cares of empire in the hunting grounds of three different continents, but the proconsuls of Pontus and Numidia invited him in vain; he stuck to his task like a slave to his treadmill, and shunned even music:

"Enjoyment from one entrance quite shut out;"

ignored panegyrics in honor of his virtues, and tolerated circus games only as a concession to the natural depravity of his subjects, who might riot in the atrocities of the amphitheater, while their ruler wore out his life with the elaboration of reform plans and sought recreation only in prose elegies and communion with the spirit of Zeno.

Now, the theory of exhaustion would have been strikingly confirmed if the offspring of the great altruist had been a rickety whimpy-owl, one of those listless youngsters supposed to be too good for the present world, but withal too indolent to aspire to the rewards of the next.

But the matrimonial venture of the sad-eyed philosopher resulted in a birth of a chuckleheaded *pupus* who grew up into a bull-necked and vindictive blackguard, a reckless egotist who passed his time with riots and the arrangement of festivals in honor of his own merits. When one of his sycophants remarked that his moral and physical perfections had never before been united in a human being, he did not hesitate to enroll himself among the Olympian gods. He wasted the revenue of a province on a single circus pageant, and not only bade grumblers go to hades, but sent them there by scores and hecatombs. "The Prætorian Guards have been pacified by an enormous bribe," said the prefect Perennis, "but had we not better do something to allay the resentment of the people, something to perpetuate our names in the memory of posterity?" "Well, you can change the name of Rome to Colonia Commodiana," said this son of a modest father.

A son of the Inquisitor Hæmmerlin was indicted for heresy, and there is a tradition about a Syrian wood devil ("satyr") who was converted by a sermon of St. Eusebius and reared a family of saints.

But from Syria comes also an anecdote that suggests a solution of the inversion puzzle. "That's Lot's wife," said Professor Berthollet's guide, pointing to a rock-salt pillar forty feet high and about four yards in diameter. "Is that so?" said the witty Frenchman. "Then I'll bet gold to copper that Mr. Lot wasn't more than five feet high."

Again, a multitude of analogies confirms the aptness of the con-

ceit. Bruisers are attracted by Mignons, light-weight dandies by two-hundred-pound peasant girls, stoics by shrews, polyhistors by unsophisticated Gretchens, saints by flirts, metaphysicians by tomboys, grimy Vulcan by Venus, moral or physical anomalies by their opposite extremes. One-sided men, as it were, instinctively seek their *complement* in the interest of the next generation, and it so happens that nearly all great men are one-sided—one or two of their faculties having been phenomenally developed at the expense of the rest.

And to complete the explanation, moral and intellectual preeminence are frequently attained at the cost of the physical organism:

> "The restless spirit, working out its way,
> Fretted the feeble body to decay;"

and Marcus Aurelius, yielding to instinct, selects a Faustina whose vital vigor gives her a superior chance to transmit her physical and moral characteristics.

Hence the portent of disparity, the *toto-cœlo* contrast between legitimate sons and such fathers as Cromwell, Bonaparte, Humboldt, Goethe, and Dante. Hence, also, the phenomenon of atavism: the necessity of neutralizing anomalies by an alliance of opposite extremes tends to repeat itself in successive generations, and two inversions may thus result in the re-establishment of a strange ancestral type.

VERACITY.

By WILLIAM HENRY HUDSON,
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IT is worth our while at times to turn aside from the investigation of the newer theories and problems of conduct, to examine a little carefully some of the older but not less weighty matters of the law. Familiarity is said to breed contempt in social and domestic intercourse; it certainly has its peculiar dangers in the domain of thought. We may grow so accustomed to a fact that it gradually loses its meaning for us; we may live so long in intimate association with a life-giving idea that little by little it lapses into dry and sterile commonplace. When this happens, it is well to force such fact or idea out again into the current of freshening inquiry, that the mind may play actively about it for a season, and its full significance be thus revealed.

If this general doctrine be recognized as sound, it may be regarded as not altogether waste of time to consider briefly the ancient and well-established ethical principle of truthfulness, or veracity.

It will not do to say that we all know that it is wrong to lie, and right to speak the truth, and that there the whole matter ends. For we shall discover, if I mistake not, that in the rediscussion even of a topic so old and apparently threadbare as this we shall come upon some points of theoretical and practical importance which, if not altogether new, may derive an element of novelty from restatement, and which at any rate will be found to furnish food for thought.

What, then, do we mean by veracity? In nine cases out of ten the answer given would be: By veracity we mean simply telling the truth; or, in other words, the making of such statements only as we believe to accord with facts. Now, this rough definition gives what we may describe as the solid substratum or foundation principle of veracity, though it is, in common affairs, rarely pressed to its full meaning. Hence we may accept it as far as it goes. Veracity will always signify, on the positive side, telling the truth; and on the negative, the avoidance of statements not in harmony with facts. But, ethically considered, while it denotes all this, it also connotes a good deal more than this; and some of its more important implications call for distinct formulation.

The complete conception of truthfulness, then, must in the first place be taken to embrace, not only the habit of saying that the thing which is so is so, but also constant care in conveying at all times the correct impression in regard to facts, and that impression only. That in every kind of prevarication, dissembling, and evasion we fall short of strict veracity, even when no directly false statement is made, is a commonly accepted principle; and in current parlance we condemn also as immoral the silence which leaves another in ignorance or with a distorted notion of reality, when we are in a position to set him right. But it is not so generally recognized that overcoloring of any sort, introduced for any purpose, exaggeration, the trick of extravagant epithets, the indiscriminate use of expletives, are to be adjudged as untruthful. How difficult it is to keep the straight line in these matters every one knows who has had occasion to tell a number of times over the story of any adventure or curious experience. Before long the magnifying tendency is almost certain to show itself; the adjectives grow a trifle stronger, the language a shade more pronounced; and unconsciously we presently begin to mold our material with an eye not upon accuracy, but upon effect. Then, after a while, like the redoubtable Tartarin de Tarascon, we lose sight of the plain and simple facts, and take our own more or less imaginative version of the story as correct in outline and color, thus deceiving ourselves.

Our common carelessness in ordinary conversation is revealed by the random employment of superlatives, characteristic of all of us, but of women perhaps more than of men; the highly charged

phrases of praise or blame, generally to be pronounced excessive; the irresponsible rhetoric of fancy and caprice. Nor do we need, in illustrating this point, to confine ourselves to everyday intercourse. Literature furnishes numerous examples of the vice of overcoloring, even where we ought least to expect to find them—in the writings of historians. Witness Carlyle and Macaulay. The work of the former is frequently rendered unveracious not only by personal passion, but also through the abuse of his enormous vocabulary of invective; that of the latter, as well by willingness to sacrifice the finer shades of analysis to the production of brilliant antithetical effects, as by the occasional irruption of bias and prejudice. Of neither of these men could it be rightly said, in Mrs. Browning's splendid phrase, that he possessed in full degree "the conscience of the intellect."

Pushing the matter still further, we should say that the conception of veracity involves, in the second place, not simply the habit of keeping close to what we believe to be fact, but due inquiry into the basis of such belief. It is one thing to stick consistently to what we take to be truth; another, but equally important thing, to make certain that we are fully justified in accepting and proclaiming it as such. There are many people who, in the daily intercourse of the world, will never be found guilty of willful prevarication or misstatement, but who none the less seldom take the time or trouble necessary to sift the stories they hear and repeat, and test the exact relation between what is reported and what has actually occurred. As "evil is wrought by want of thought as well as want of heart," so also are we often confused and misled, sometimes regarding issues of serious moment, by the mental laxity, inertness, or inattention of ourselves or others, no less than by positive falsehood or malicious dissimulation. How little this side of the question appeals to most of us is clearly shown by the circumstance that the defense, "I thought is was so and so," or, "Well, I didn't know any better at the time," or "Such and such a person told me so," is currently urged and accepted as sufficient answer, when any statement, subsequently proved to be incorrect, is traced back to its immediate source. But no such excuse is ethically valid. The proper rejoinder in all such cases is: "You ought to have known; you ought not to have made allegations or offered opinions until you had been at proper pains to convince yourself of the soundness of what you said." Matthew Arnold once remarked that the English are very good in following their consciences; where they are not good is in finding out first of all whether their consciences are leading them right or wrong. But, in view of the fully developed principle of veracity, we must hold a man responsible, up to the uttermost limit of his opportunity, for knowing the truth as well as for speaking it; for investigating the

grounds of his beliefs and judgments, no less than for frankness and courage in the expression of them. In a word, we must insist on enlightenment—on the intellectual as much as the narrowly called moral aspect of the matter.

And this leads us to the conclusion that veracity, at bottom, signifies nothing less than the cultivation of a love of truth for its own sake, and is, therefore, fundamentally synonymous with intellectual integrity, absolute soundness and sanity of mind. Observe, then, the further implication. To complete our conception of veracity we have to remember that it means not alone speaking the truth, not alone proper care in ascertaining what is truth, but also thoroughgoing, unhesitating readiness to accept fact as fact, no matter how unpleasant it may seem to be. This point needs emphasis; for, hard as it may appear to have to say so, there are very few of us who are not, at some times, under some circumstances, guilty of imagining that what we like is the final measure and criterion of what is; few, therefore, who in practice live up to that ideal of complete mental honesty which demands repudiation of all prejudice, snap judgment, self-delusion, make-believe, a stern determination to see things as they are, and the corresponding willingness to adjust ourselves resolutely and without murmur to what is shown to be reality. Presented with a new idea, we are too often inclined to ask—not, What is the evidence for or against it? but, How will it suit my tastes?—not, Is it true? but, How is it likely to affect my present creed? But only when we feel able to declare with Clough, "Fact shall be fact for me, and truth the truth as ever"; to realize with Amiel that "the world must adapt itself to truth, not truth to the world"; and acknowledge with Froude that "whatever the truth may be it is best that we should know it"; and, at the same time, carrying these principles out into practice, make them the impelling and guiding forces of our lives—then, and then only, have we a right to say that our intellectual foundations are deeply and firmly laid.

But such a result requires self-culture of the widest as well as the severest kind, for it calls for balance and regulation of feeling no less than for mental alertness, vigor, clearness, and honesty. Before we can "see life steadily, and see it whole," we must have the entire nature under the complete control of that conscience of the intellect to which reference has been made; we must have trained ourselves up to a degree of fortitude sufficient to bear without flinching what Bagehot once described as the sharpest of all pains—the pain of a new and unwelcome idea. Often enough a fresh truth will bring us not comfort or the sense of satisfaction, but the reverse of these—doubt, misgiving, heart-anguish, agony of mind. The peace and joy which we once found in an older order of thought may hence-

forth be ours no longer; while, in place of a philosophy of life which had grown rich and sacred to us through association, we may have to accept a new theory of the universe and man which for a time at least may seem chilly and bleak and depressing. In such a crisis as this—and few serious-minded men of our generation can hope to escape some mental upheaval attendant upon the progress of thought—we must nerve ourselves with the high doctrine of veracity: "Let fact be fact, and life the thing it can"—first, the truth as we can learn it, and then, whatever happiness or comfort may be gained from it for ourselves and others.*

Even this is not quite all. Strict adherence to veracity, still further analyzed, will be found to include not simply fortitude in facing new truths for ourselves, but also the faith that, in the long run, truth will always be better than error for the world at large. Here, of course, we touch a question of acknowledged difficulty, and one of which no adequate treatment can be undertaken in this place. Yet the difficulty must at least be presented. Given a creed or scheme of life which seems to bring hope and comfort to "the complaining millions of men," and many of us, while ourselves convinced of its unsoundness, will more or less deliberately cherish the opinion that it is, on the whole, best that the world should be left unenlightened; and we find a kind of theoretic basis for our position in the modern evolutionary doctrine of the congruity which exists in the average of cases between culture and belief. Many of the older ideas out of which past generations drew strength and inspiration may appear to us to be forever discredited. But shall we, therefore, carry our conclusions out into the common places of life—into the streets, the markets, the schools? Shall we force them, from the outside, upon those intellectually and morally unprepared to receive them? Shall we preach them as truths "to those that eddy round and round"? How great is the responsibility of each of us in these matters will be felt at once by all to whom the present problems in conduct are something more than questions for academic speculation. Is there not, it may be urged, a time and a season for all things—even for speaking the truth? And though it may never be conceived as part of our duty to state publicly what we know to be false, may we not oftentimes be justified in holding our tongues?

I need hardly say that this is a difficulty to which thoughtful men have been fully alive from the time of the Greek and Roman moralists onward. In our own day it has been powerfully presented in one

* Noteworthy examples of courage shown in the acceptance of what the writers deemed truth, though unpalatable truth, will be found in James Thomson's sonnet, A Recusant; the last chapter of Romanes's Candid Examination of Theism (published under the pseudonym of Physicus); and the concluding paragraphs of Pearson's National Life and Character.

of Ibsen's strangest and most enigmatical plays, The Wild Duck. What I have elsewhere written about this extraordinary work bears so directly upon the issue now before us that I may be pardoned for reproducing a portion of it here: "After all, I do not think that it is very difficult to see the point of connection between this play and the body of Ibsen's work. It seems to me to have been the writer's purpose to clinch the ideas already set forth in Hedda Gabler, though allowance must be made for the presence and coloring of an even more dejected mood. Truth may prove destructive; but then it will be the fault not of truth but of ourselves. Its boasted liberty is a blessing to those only who are fit for liberty; to many it may prove nothing more than a short cut to ruin. Men must be educated, not only in truth, but for truth. You can not make people free from the outside. They must achieve freedom for themselves, by inward growth. You may strike off their shackles, but this will only give a man who is a slave by nature an open chance to plunge into a still more desperate servitude. It is useless, worse than useless, to offer new knowledge where the recipient lacks spiritual strength and flexibility to adjust himself to the larger claims which it will undoubtedly force upon him. Gregers Werle, in the play, makes ideal demands upon an individual mentally and morally unable to rise to the level of the occasion; what marvel, then, that the experiment proves fatal to all concerned? It is, therefore, perhaps fair to regard The Wild Duck as a kind of complement or sequel to An Enemy of Society. In the latter drama, Ibsen boldly proclaimed his right to speak out, come what might of it; in the present work, on the other hand, he mournfully acknowledges that the gospel he brings to the world—true gospel though he conceives it to be—may none the less be fraught with vast and incalculable dangers for a society made up for the most part of people like those we meet in the play. . . . Is it not best, he seems to ask, just to leave them as they are? Who shall shoulder the responsibility of uttering the new word, knowing that while it is potent to save, it is also potent to destroy?"

Thus, as well as I am able to read it, runs Ibsen's thought; and the doubt which it expresses must from time to time have been felt by most of us. To proceed further with the discussion of the question thus opened up would here commit us to an unwarrantable digression into casuistry. It therefore must for the present be left where it is.* I have raised it with a view only to completeness—that is, to show that the full conception of veracity implies faith in truth as well as love for truth; whether we can any of us declare

* The reader desirous of following up this part of the subject will be glad to be reminded of John Morley's extremely able essay On Compromise.

ourselves in favor of absolute veracity in this respect is quite another matter.

We may now regard our subject from a different point of view, briefly considering veracity under the three partially independent forms distinguished by Mr. Lecky—the industrial, the political, and the philosophical.*

1. Industrial Veracity.—By this we may understand, with Mr. Lecky, "that accuracy of statement and fidelity to engagements which is commonly meant when we speak of a truthful man." The description of this kind of rectitude as "industrial" may, however, cause some surprise, since the idea that the industrialization of life has cultivated not candor, but mendacity, is deeply rooted in popular thought, and finds numerous expressions in literature—as, for instance, in Pope's line—"The next a tradesman, meek, and much a liar." † And that this common notion is apparently supported by many conspicuous facts can not be denied. We are all of us too familiar with the countless abuses of trade as they come home to us in our own experiences—with the tricks and subterfuges to which all classes of dealers resort, the adulteration of almost everything we eat and drink, the lying advertisements of our newspapers—to need to be reminded that the commercial spirit is not in these days marked by any profound respect for truth. Might it not even be urged that, in this particular respect, we have lost by the encroachments which industrialism has made upon the old chivalrous code of honor? That code—at least as we know it through romance—insisted upon a certain integrity of character, squareness of dealing, honesty even with enemies. But a moment's thought will convince us that, after all, these manifest facts give us only one side of the matter. It is equally certain that, whatever results may reveal themselves in practice, nations come more and more to recognize in theory the need and importance of veracity as their relations grow more and more industrial. Mutual confidence, like justice, is a prerequisite condition to industrial development; and mutual confidence is possible only when people as a whole fulfill their promises, keep their engagements, and to some extent stick to the truth. Even the abuses of trade are, in a certain sense, evidence of the growth of general veracity. The liar depends for the success of his lying upon a broadly accepted tradition of truthfulness; the dishonest trader is as much interested as those whom he cheats in the honesty of other people. If no one were expected to speak the truth, false statements would lose their value;

* European Morals, third edition (New York, 1891), vol. i, pp. 137–139.

† Moral Essays, i, 152. See also Tennyson's vigorous denunciation of commercial morality in Maud.

if we all ceased to believe in fair dealing, the deceiver's occupation would be gone. As Mr. Lecky says, in industrial societies "veracity becomes the first virtue in the moral type, and no character is regarded with any kind of approbation in which it is wanting. It is more than any other the test distinguishing a good man from a bad man. . . . This constitutes probably the chief moral superiority of nations pervaded by a strong industrial spirit over nations like the Italians, the Spaniards, or the Irish, among whom that spirit is wanting. The usual characteristic of the latter nations is a certain laxity or instability of character, a proneness to exaggeration, a want of truthfulness in little things, an infidelity to engagements, from which an Englishman, educated in the habits of industrial life, readily infers a complete absence of moral principle." We may even go with him when he adds, "The promotion of industrial veracity is probably the single form in which the growth of manufactures exercises a favorable influence upon morals."

It is important to note the almost entire absence of this kind of veracity among the Greeks, because this fact shows us that truthfulness is not necessarily the result of a high state of civilization, but only of a state of civilization accompanied by such life conditions as tend to make truthfulness a habit. And if we inquire what such conditions are, we shall probably find that they depend, more than upon any other single cause, upon the gradual subsidence of the *régime* of mutual antagonism, and the rise of the *régime* of mutual help.* So far as industrialism has abated the struggle for existence among individuals and nations, it has promoted veracity; while to the extent to which it only keeps this struggle alive under changed forms, it merely perpetuates the untruthfulness which was from the first a concomitant of such struggle.

2. Political Veracity.—By this, still following Mr. Lecky, we mean the spirit of impartiality which, in matters of controversy, desires that all facts, arguments, opinions, should be freely and fully stated—in a word, the spirit of fair play. We call it "political," because it is undoubtedly to be interpreted as a growth, immediately, out of developing freedom in political life. Democratic progress, then, provided it be democratic in reality as well as in name, will favor the spread of this particular form of truthfulness; coercive rule (whether it come through the tyranny of the one or of the many) will always prove hostile to it. It suffices here to observe these connections, without undertaking any analysis of the relations subsisting between forms of government and social activities. A free platform

* For evidence on this point, see Spencer's Principles of Ethics, Part II, chapter ix. Mr. Spencer, of course, connects the growth of veracity, directly or indirectly, with the decline of militancy and the spread of peaceful activities.

and press, open debate, the habit of challenging, sifting, criticising—these are the conditions which foster the spirit of political veracity; where they do not exist we shall search for it in vain. The famous conversation between Tom Brown and Harry East on the ethics of lying, with the conclusion of the latter that there is nothing wrong in deceiving a master if you can do it with safety, simply expresses in little what is everywhere exhibited at large by the moral history of the world. For the spread, therefore, of this form of truthfulness we must look to the decline of despotic authority and to the democratic habit of unchecked discussion; and we must expect to see it accompanied, on the one hand, by increased self-dependence and insistence on one's own right of thought and speech, and, on the other hand, by a wider and more generous toleration of the opinions of other people.

3. Philosophical Veracity.—This may be defined as the most abstract and disinterested form of truthfulness—the simple love of truth for its own sake. The conditions of its development are complete emancipation from prejudice and party contentiousness, freedom from the disturbing influences of passion, tradition, personal and other kinds of bias, the cultivation of a calm and judicious spirit in all matters of controversy, and that steadiness of mental vision which enables us to envisage without wavering the hardest and most disagreeable facts. It is this pure and unreserved devotion to truth as such—this complete willingness to follow whithersoever it may lead—that more than anything else distinguishes the man of the highest mental character from those of lower types—which marks off the philosopher, properly so called, from the heated partisan, the bigoted sectary, the whole crowd of ignorant, ill-reasoning, or indifferent adherents of churches, classes, schools. It is to be considered as the last and noblest of the intellectual virtues—the very flower and fruitage of the finest developments of thought.

This form of veracity, it is evident, then, is possible only in certain high states of civilization, wherein mental freedom and alertness, a wide interest in every field of inquiry, and the largest and most solid intellectual culture, combine at once to establish the ideal, and to bring about and maintain the conditions necessary to its attainment. But we must not rest content with these rather vague and general statements. We must investigate a little more closely the habits of life and thought, and particularly the kind of mental discipline, by which philosophical veracity is fostered and strengthened.

After all, the question thus introduced is, fortunately, a very simple one. If, remembering that we have here to do with a love of truth as such, with the desire to know all that is to be known about any subject, and with the willingness to accept whatever is proved to

be fact, no matter whether it may fit into our preconceived theories or make havoc of them, we ask: How best are these high qualities to be cultivated? What is the method and training by which such results are to be secured?—we shall find that in the very terms of our statement the answer is clearly given by implication. It is in the scientific spirit, and in the spread of scientific ideals, methods, and habits of mind, that we have to seek the ultimate cause of philosophical veracity. Of this austere virtue, science itself offers the one great training school. We are there taught, as we are taught nowhere else, to estimate evidence and weigh hypotheses; to discount ready-made conclusions, and set aside authority and tradition; to look steadily at facts and theories, and hold lightly to creeds and systems as, in the nature of things, nothing more than provisional. Such drill, such training in mental conduct, is bound to affect the whole life, nurturing patience, reserve, precision of observation, thought, and statement, care in forming opinions, the judicial temper of mind, on which stress has been laid. Nor is this all. Science furthermore teaches us, and beyond all things else, to seek fact as fact, allowing the judgment to be in no way swayed or disturbed by any consideration of its real or supposed consequences. Elsewhere, truth may be made subordinate to social convenience, established philosophies, pet theories of man, nature, and God. In science, it is sought for its own sake, and from first to last is held supreme.

The difference between the scientific and the non-scientific spirit in these important matters is made clear when we remind ourselves that almost every great conclusion established by scientists has at the outset been angrily denounced on account of its imagined bearings upon questions of conduct or the creeds of the organized churches and schools. When, to take only a single conspicuous illustration, Darwin published the results of his investigations into the origin of species and the descent of man, pulpits and newspapers all over the civilized world vehemently attacked the new doctrines because "they made a personal God unnecessary," or "debased man to the level of brutes," or "tended to materialism," or "contradicted the first chapter of Genesis," or did something else equally impertinent, equally subversive of preconceived ideas. And even where no rancor was shown, the position too often assumed was no less fatal to genuine veracity. "Here is the established creed of my party and church; as this is truth, whatever does not harmonize with it must be false; the Darwinian hypothesis does not harmonize with it—it is therefore false; it only remains in one way or another to disprove it; let me cast about to see how this can be done." This, I think, is no unfair description of the popular plan of campaign; and

it is easy to see that here we have the intellectual attitude and temper, not of the calm, unprejudiced judge, but of the interested, brief-holding advocate—an attitude and temper which must inevitably lead to prevarication, special pleading, evasion, and the innumerable evils of sophistry.

In the so-called conflict of science and religion—which in reality is the conflict of newly discovered truth with older and exploded theories of things—we are thus shown again and again that while the finest discipline for philosophical veracity is to be found in the growth of the scientific spirit, its worst foe is always to be sought in the diametrically opposite spirit of theology. "Science abhors finality in belief," said a distinguished English clergyman,* "but this is precisely what theologians like. Science discovers facts, but theology accepts revelation, and clings to creeds." Exactly; and the contrasted mental results brought about by such conditions respectively need scarcely be specified. Science has no creed to support; theology has always had, and always will have. Science, therefore, is free to look at all theories from the point of view of facts; while theology is bound to look at all facts from the point of view of accepted theories. In this simple circumstance lies a part explanation of the everlasting warfare between them.

But the spirit of theology is hostile to strict veracity for other reasons than this finality of belief, this tenacity in regard to established creed. Theology professes esoteric knowledge of what lies beyond the reach of verification, and thus breeds contempt for the processes of verification and disparagement of their importance. It labels all sorts of things which transcend knowledge, or contradict accumulated evidence, "mysteries," thus dismissing them from inquiry and encouraging looseness of thought. It fosters undue reverence for tradition, authority, the "wisdom of our ancestors," and therefore tends to mental dependence, sluggishness, and debility. It postulates belief as the ideal of the intellectual life; proclaims implicit faith the greatest of virtues; teaches credence in default or in spite of testimony; and so condemns the skepticism, balance of judgment, reservation of opinion, acknowledgment of nescience, in the absence of which the quest for truth is impossible, and which are often the last results that the truthseeker is able to offer as the reward of all his toil. Finally, theology, by its familiar device of "reconciling" science with its own postulates when the conclusions of science are no longer to be ignored or abused, undermines frankness, straightforwardness, the sense of honor and fair

* Dr. Magee, late Bishop of Peterborough.

play, and cultivates that habit of equivocation, subterfuge, hair-splitting, and forced interpretation, than which nothing can be more disastrous in its influence on the intellectual life.

We do not wonder, then, that in the "ages of faith"—in the days when theology held undisputed sway—truth should have been so little prized, and falsehood, provided only it were falsehood in a good cause, held so venial. John Sterling's uncompromising words on leaving the priesthood—"No, I can not lie for God"—are very far indeed from describing the mental attitude of the early and mediæval Church. "By the fourth century," says Mosheim, "the monstrous and calamitous error" had taken possession of the ecclesiastical world, "that it was an act of virtue to deceive and lie when, by that means, the interests of the Church might be promoted." The history of the Church and councils, and of the growth of Christian doctrine, only too clearly shows to what extent this principle was put into practice.* "This absolute indifference to truth," writes Mr. Lecky, "whenever falsehood could subserve the interests of the Church, is perfectly explicable, and was found in multitudes who, in other respects, exhibited the noblest virtue. An age which has ceased to value impartiality of judgment will soon cease to value accuracy of statement; and when credulity is inoculated as a virtue, falsehood will not long be stigmatized as a vice. When, too, men are firmly convinced that salvation can only be found within their church, and that their church can absolve from all guilt, they will speedily conclude that nothing can possibly be wrong which is beneficial to it. They exchange the love of truth for what they call the love of *the* truth." † Thus, under the predominating influence of theology, men came to care more for creed than for veracity; and among the countless evils which followed as a matter of course, the habit of persecution sprang up and grew apace. Strictly logical, from the theological standpoint, this habit simply carried accepted principles over from theory into practice. In attacking opinions with the strong arm of civil authority, in punishing them with bodily torture, men merely treated the quest of truth as a social crime, when already it had been denounced as a religious sin.

So far as philosophical veracity is concerned, therefore, we have to conclude that its growth must depend almost wholly upon the decline of the theological and the spread of the scientific spirit. And, indeed, whatever else the expansion of science may do for men in the years to come, it is probably just in this extremely important

* On the mendacity of the early Church and the way in which it forged prophecies and fabricated evidence, see, e. g., Lecky's History of Rationalism, vol. i, pp. 434, 435.

† History of European Morals, vol. ii, p. 213.

particular that its influence will be most pronounced and most beneficial in the intellectual life of the world at large.

This little essay has been intended simply to give some of the most important principles of veracity in a purely abstract statement. Special questions and problems have, therefore, been purposely left untouched. All moralists, it may be assumed, will agree that, in the actual ordering of life, there are occasions when not only are we not called upon to speak the truth, but when even by direct lying we incur no proper reproach. To mislead the would-be robber concerning the exact whereabouts of the family plate is clearly justifiable; and so, too, is the false statement of his condition by means of which, as every physician knows, a patient is often given a better chance of recovery. Numerous cases of these or other kinds will occur in common experience; there is unfortunately no single rule of conduct which can be taken as inflexible and universal in its applicability; and we must each of us face the individual crisis when it arises as best we can. But meanwhile it may be useful sometimes to consider general and fundamental principles in ethics without relating them to exceptional issues. After indulging in such a discussion as the foregoing we may, it is possible, be inclined to say that, as Rasselas was convinced by Imlac that no human being could ever be a poet, so are we fully convinced that we can never be wholly and consistently truthful. Yet it may help us none the less to have the ideal distinctly set before us, and whatever difficulties may be in the way of our approach to it, it will never cease to be our duty to hold it steadily and bravely in view.

AFTER Heinrich Hertz had gone to Munich to study engineering in 1877, he wrote back to his parents that he wanted to change his plans and return to the study of natural science. He felt that the time had come either to devote himself to this entirely or else to say good-by to it; for if he gave up too much time to science in the future it would end in his neglecting his professional studies and becoming a second-rate engineer. His parents consented to his desire and his course of studies was changed in conformity to it. A year later he wrote from the laboratory that the greater part of the time spent there was devoted to "things which are very useless, or at any rate don't teach one much, such as cutting cork and filing wires, and the observations themselves are naturally not very delightful. Possibly it may be doubtful whether it is quite right for me to spend so much time at these things when I still have so much to learn. And yet I feel that it is right; to get information for myself and for others direct from Nature gives me so much more satisfaction than to be always learning it from others and for myself alone—so much more that I can hardly express it. When I am only studying books I am never free of the feeling that I am a perfectly useless member of society."

THE SERPENTLIKE SEA SAURIANS.

By WILLIAM H. BALLOU.

IN the latter part of the Mesozoic age there was a great inland ocean, spreading over a large part of the present continent. The lands then above water were covered with a flora peculiar to the times and were inhabited by some of the animals which later distinguished the Cenozoic age. In the seas were reptiles, fishes, and turtles of gigantic proportions, armed for offense or defense. There were also oysterlike bivalves, with enormous shells, three or four feet in diameter, the meat of which would have fed many people. In time, this great ocean, swarming with vigorous life, disappeared. Mountain ranges and plains gradually arose, casting forth the waters and leaving the monsters to die and bleach in Tertiary suns. As the waters remaining divided into smaller tracts, they gradually lost their saline stability. The stronger monsters gorged on the weaker tribes, until they, too, stranded on rising sand bars, or lost vitality and perished as the waters freshened. In imagination, we can picture the strongest, bereft of their food supply at last, and floundering in the shallow pools until all remaining mired or starved. It would be interesting to know how much of the great Cretaceous ocean forms a part, if any, of the vast oceans of to-day. If any part so survived, what became of the saurians carried forth into new ocean areas? Were they beaten on jagged rocks by powerful currents and destroyed, or did some of them escape only to perish in after ages? Water, as a rule, seeks its level; sometimes it is evaporated. If the Cretaceous ocean merely drained off into other areas before rising lands, it is perhaps not unreasonable to suppose that the descendants of some of the saurians might have survived in the Atlantic or Pacific as they had existed in the Mesozoic age. We can therefore only assume that the Cretaceous seas evaporated or gradually freshened until all the life they contained became extinct.

During the past twenty-five years explorers have collected tons of skeletons of the stranded sea serpents, or better, perhaps, serpentlike sea saurians. A sensational world has ever been on the lookout for sea serpents. It is possible that such tendencies are inherited from a very remote ancestor, a primeval, manlike animal, whose curiosity was aroused by glimpses of some surviving pythonomorph.

Almost everywhere on the expanse of the Cretaceous ocean might have been seen the snakelike forms of the elasmosaurs, the heads arrow-shaped, upheld by swanlike necks, rising from ten to twenty feet above the surface and scanning the sea or air for prey or enemies. The prey located below, they dived; the enemy seen

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THE GREAT CRETACEOUS OCEAN. Drawn by J. Carter Beard.

Mosasaurs: 1, *Platecarpus coryphæus* (Cope); 2, *Tylosaurus proriger* (Cope); 6, *Mosasaurus horridus* (Williston); all restored by Williston. 3, Marine turtle: *Protostega gigas* (Cope), restored by Case. 4, Bulldog fish: *Portheus molossus* (Cope). 5, Pterosaur: *Pteranodon*, or *Ornithostoma ingens* (Marsh), restored by Williston. 7, Plesiosaur: *Polycotylus latipinnis*, as restored by Dames.

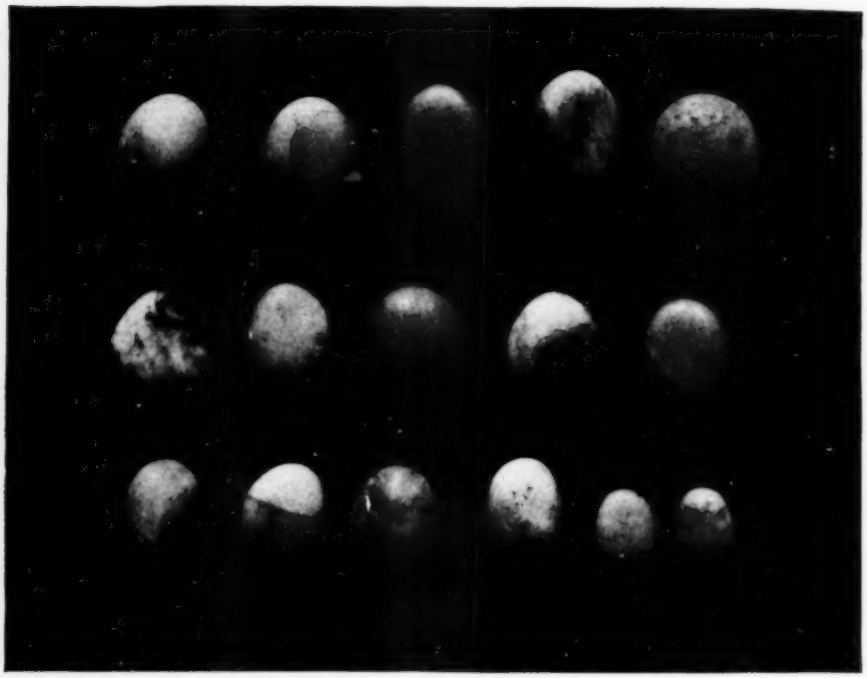
approaching, they swam away with incredible speed. A flock of them must have resembled the shipping of a harbor with tall masts yellowing in the sunlight. At the base of the long necks were elephantine bodies, and behind, long, tapering tails. Forward and behind were two sets of paddles, perhaps terminating with webbed digits. With the forward paddles Cope thought that they might have seized prey; with all four paddles they swam. From thirty to sixty feet in length, they were well adapted to the deepest waters and to breast the waves of the seas. Like swans and Floridian snake birds, they plunged their necks downward for prey, the body perhaps remaining on the surface as an anchor. Carnivorous, the elasmosaur ate what it could seize, and to-day, with its bones, are found the bones of its victims, usually fishes. Somewhat similar were the cimoliosaurs, even longer necked at times, but with shorter and more powerful tails. Their paddles were long, and as swimmers they must have had few equals in speed. Smooth silicious pebbles to the amount of a peck or two have been found in numerous instances associated with the remains of plesiosaurs of various kinds. They evidently formed a part of the contents of their stomachs, but their use is not clear. But the real rulers of the Cretaceous ocean were the pythonomorphs, or mosasaurs, more like the typical serpents of to-day, and more entitled to be called sea serpents.

The mosasaurs were more elongated and graceful in form. Their heads were large, flat, and conical, with the eyes directed laterally. The tails were long. They had fore and aft paddles with webbed digits, attached to the body with wide peduncles. With paddles and flattened tails they swam with ease and speed. Like snakes, they had four rows of formidable teeth on the roof of the mouth, not for mastication, but for seizing prey and holding it. Like snakes, they swallowed their prey entire, but, unlike snakes, they had not elastic throats. The jaw was, however, so articulated, jointed so far back between the ear and chin, ball-and-socket fashion, that the immense opening made up for the lack of expansibility of throat. The ends of the jaws were bound by flexible ligaments, permitting the passage of large fish or other prey. The mouth of the gullet was prolonged forward while swallowing, evidently being loose and baggy. The same habit pushed forward the glottis, or opening of the windpipe in front of the gullet. Like a serpent, the mosasaur hissed, owing to these formations. The tongue was long and forked, and when at rest was inclosed in a sheath beneath the windpipe and thrown out when the jaws were in motion. And thus, too, are the nearest living forms.

The mosasaurs attained great length, reaching from ten to fifty feet. They had long, projecting muzzles, somewhat like that of the

blunt-nosed sturgeon of to-day, although the branches of the lower jaw were correspondingly massive. With such ramlike jaws the mosasaur possessed terrible powers of collision. They were scaled animals, and fragments of their hide and scales have been found in good condition of preservation.

The first mosasaur discovered was found by Major Drouin in 1776, on the banks of the river Meuse, near Maestricht, Germany. On this specimen was founded the genus *Mosasaurus*, given it by Conybeare in 1822, although the skeleton was previously described



Silicious Pebbles from the Stomach of a Plesiosaur.

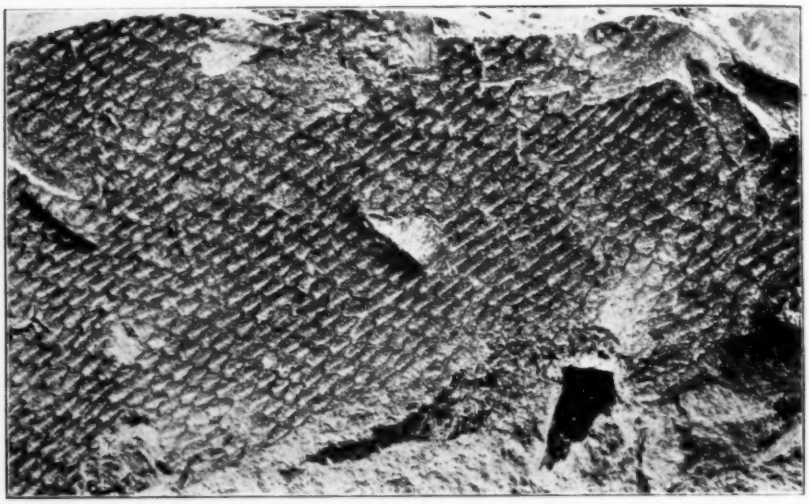
by Cuvier in 1808. The interesting history of the specimen, which created a profound sensation in the world of learning and became mixed up in the history of nations, is herewith reduced from Owen. The skull was found in the quarries of St. Peter's Mount by M. Faujas Saint-Fond, Commissary for Sciences of the French Army of the North. In one of the galleries or subterraneous quarries in which the cretaceous stone of St. Peter's Mount was worked, about five hundred paces from the entrance and ninety feet below the surface, the quarrymen exposed part of the skull in a block of the stone which they were engaged in detaching. On this discovery they suspended work and went to inform Dr. Hofmann, surgeon of the forces of

Maestricht, who for some years had been collecting fossils at this quarry, remunerating liberally the workmen for the discovery and preservation of them. Dr. Hofmann arrived at the spot and saw, with extreme pleasure, the indications of a magnificent specimen. He directed the operations of the men so that they worked out the block without injury to the skeleton, and he then with his own hands cleared away, by degrees, the yielding matrix, exposing the extraordinary jaws and teeth, which have been the subject of so many drawings, descriptions, and discussions. This fine specimen, which Hofmann had transported with so much satisfaction to his collection, soon, however, became a source of chagrin to him. Dr. Goddin, one of the canons of Maestricht, who owned the surface of the soil beneath which was the quarry whence the fossil had been obtained, when the fame of the specimen reached his ears, pleaded certain feudal rights in support of his claim to it. Hofmann resisted, and the canon went to law. The whole chapter supported their reverend brother, and the decree ultimately went against the poor surgeon, who lost both his specimen and his money, for he was made to pay the costs of the action. The Canon Goddin, leaving all remorse to the judges who had pronounced the iniquitous sentence, became the happy and contented possessor of this unique example of its kind. But justice, though tardy, comes at last. When the town was bombarded by the French, directions were given to spare the suburb where the famous fossil reposed. After the capitulation, the grenadiers discovered, seized, and bore off the specimen in triumph to the commissarial residence. The excellent soldiers always knew how to appreciate and respect the monuments of art and science. The mosasaur was transplanted and still remains in the Museum of the Garden of Plants, Paris, and is the subject of more literature than any extinct animal.

Remains of the mosasaurs were first discovered in England in 1833, at Lewes. In America, mosasaurs were first found in the cretaceous beds at Great Bend, Missouri, about the year 1820, by Major O'Fallon, Indian agent. He found a fine specimen, and took it to his home in St.Louis. Dr. Goldfuss first described it in 1843, with accompanying plates, the skeleton having been taken to Germany by Prince Maximilian. He defined the parietal and jugal arches, pterygoids and vomers, the position of the quadrate, and the presence of the sclerotic plates. Since that time our knowledge of the mosasaurs has been largely increased by the explorations and efforts of Cope, Marsh, Dollo, Owen, Leidy, Williston, Baur, Merriam, Gaudry, Gervais, and others. Cope, perhaps, defined the largest number of species. Marsh defined the stapes, columella, transverse and hyoid, and the presence of hind limbs. Dollo has materially increased the

data of mosasaurs and has added four new genera. Baur gave the first complete description of the skull of a species of *Platecarpus*. Williston and Case first described the vertebral column and extremities and the general form of mosasaurs. The former has contributed most to our knowledge of mosasaurs in the Kansas Cretaceous, and made the first correct restoration, which is made one of the bases of this paper.

Professor S. W. Williston, University of Kansas, because of his perfected restorations and wide studies of the sea-serpentlike saurians, the mosasaurs and other marine saurians, must rank as the highest



FRAGMENT OF SCALED SKIN OF MOSASAURS. Natural size.

authority. It is largely on his material that it is possible to present something like a complete view of the gigantic monsters that swam the Cretaceous seas and gave origin to our notions of mythical sea serpents. Kansas is the great center of the Cretaceous time of occupation, and it is within its borders that the largest number of species and genera of sea serpents have been discovered. It is natural, perhaps, that living in the vicinity of the most prolific Cretaceous remains, Professor Williston should be better able than scientists more remote to complete our knowledge of marine saurians.

There are three groups of the serpentlike sea saurians—the ichthyosaurs, plesiosaurs, and mosasaurs. Of the mosasaurs, Kansas has produced the largest number of species, twelve of which have been satisfactorily described. New Jersey, Alabama, Carolina, and Mississippi have perhaps ten valid species. Dakota has favored us with three species. It is estimated that of fifty species attributed to North America, about twenty-five or thirty will be distinguished as dis-

tinct. It is expected that in the Fort Pierre formation of the Dakota region other species will be found, as it has been but imperfectly explored. Europe has about a dozen species, and New Zealand several more. Probably only about forty species of twice as many alleged to have been discovered in the world will stand the test of critical examination.

Of plesiosaurs, America has produced about ten and the Old World many more species that will stand. Many species of ichthyosaurs are recorded from Europe, India, Africa, Australia, New Zealand, and the arctic regions, and one or two in America, the toothless *Baptanodon* from the Jurassic of Wyoming being the type. All three groups had paddles with webbed digits, but none had claws. Williston thinks that the ancestors of the mosasaurs were land lizards. Dollo thinks that the ancestors were the peculiar group of lizards which appeared in the commencement of the Cretaceous known as *Dolichosauria*. Baur would derive the mosasaurs from even more specialized lizards, and believes that their relationship is very close to the monitors of the present day.

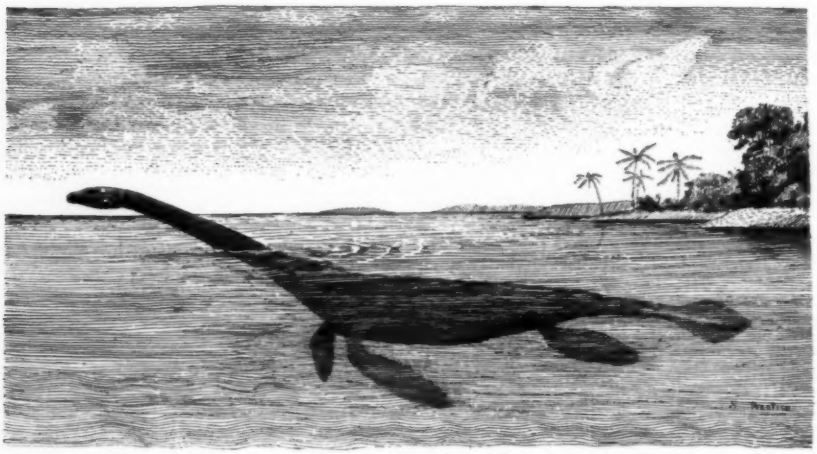
The ichthyosaurs are thought by Cope to be derived from *Homœosaurus* (beakless lizards) of the Jurassic; and these from the *Palæohatteria* (ancient hatteria), a rhynchocephalian (snout-head) which flourished as early as Permian times; and these from the *Labitosaurus*, an ancestor below the Carboniferous in the Palæozoic age; from which also sprang the lizardlike saurians, the dimetrodons (*Otocœlius*), which gave origin to the turtles (*Testudinata*). Some members of the group to which the plesiosaurs belong were land animals, and hence the origin of the whole group is clearly from land species. It is not now presumed that the marine saurians had much power of progression on land, but they may have climbed on to the beaches to lay their eggs. It is further presumed by Morris that in later times the eggs of saurians were devoured by other animals,* contributing to the extinction of all saurians.

Three species of representative genera of Kansas mosasaurs have been restored by Williston from material in the University of Kansas.

Clidastes velox (Marsh) is a typical mosasaur, the perfected skeleton of which is twelve feet in lenth. *Pumilus*, of the same genus, is given as six feet in length, which would rank it as perhaps the smallest mosasaurian. The clidastes of Kansas had short, powerful propelling tails, which would indicate a lesser speed than that of their longer-tailed contemporaries. The clidastes had small hind limbs, showing further deficiency in speed. The animals were

* Thought by Cope to have been the multituberculate *Prototheria*.

slender, with short heads. The vertebræ were firm, closely articulated with the best system of interlocking of any of the mosasaurs. The limbs were flexible and strong, with closely articulating bones and fully developed tarsus and carpus. The aggregate of these characters indicates the most snakelike form and method of progression through water of all the mosasaurs. The genus *Clidastes* was founded by Cope in 1869, but may ultimately give way to the genus *Mosasaurus* of Conybeare. Cope's views of Clidastes conclude that the animals were not as large as those of the genus *Liodon* (Owen), but more elegant and flexible, with an addi-



Restoration of the Plesiosaur by Prof. S. W. Williston.

tional pair of articulations at either end of each vertebra—the zygosphenes—to prevent dislocation by contortions. A larger and still more elegant species was *Clidastes tortor* (Cope), with lithe movements which enabled it to capture fish by means of its knife-shaped teeth, which were very numerous. Tortor was very slender, with a long and lance-shaped head. It was upward of twenty feet in length, with a head two feet and a half long, the vertebral column elongate and the head narrow and pointed.

The second-type mosasaur perfected by Williston is *Platecarpus coryphæus* (Cope). Its special characteristics are a short muzzle, slender vertebræ, and an imperfect interlocking zygosphene. The hind paddles are smaller than those forward, but thought to have been more powerful propelling functions than those possessed by other genera. A type skeleton measures fourteen feet, and may have been a young animal. The teeth were very curved and pointed, and formed effective weapons. The neural spines, not closely connected, indicate flexibility. The general characters suggest a power-

ful predaceous sea serpent. The genus was founded by Cope in 1869; it has a wide distribution, and seven or eight species belong to it.

Tylosaurus proriger (Cope) is the third of Williston's type Kansas specimens perfected in restoration. It is considered the most specialized of the mosasaurs. The skeleton in hand is twenty-three feet in length, and shows a wholly cartilaginous carpus and tarsus, more elongated digits, and a greater number of phalanges than possessed by any other genus, the result of long aquatic habits. The hind paddles are the largest, and the fifth digit has undergone but little reduction, indicating characters of a very primitive rank. The vertebræ are more flexible than in other genera, but they are relatively smaller and not at all strong. The skull is more elongated anteriorly. In the same genus was a much larger species, *T. dyspelor* (Cope), which was one of the most formidable of the mosasaurs. Another perfected sea serpent of terrible powers was *Mosasaurus horridus* (Williston), which had a ram nose, and evidently battered its foes when he could get at them. Williston's perfect skull from Dakota enabled him to correct many errors in vogue. The new genus *Brachysaurus*, formed by Williston, contains one species defined by him—*Overtoni*, from Dakota. It had a stout, very broad head, stout jaws and teeth, and stout, broad paddles. In appearance it suggests a terrible fighter, unadapted to rapid pursuit or flight.

A number of remarkable skeletons of mosasaurs have been discovered of late, some of which are expected to develop new species and, perhaps, new genera. Few of the "finds" of explorers create such sensational interest in scientific circles as the unearthing of the gigantic saurians. Three new skeletons were lately taken by an exploring party of the American Museum of Natural History. Prof. W. T. Lee, of the University of Denver, was so fortunate not long since as to secure the first skeletons of mosasaurs ever taken in Colorado, and adds so much to the geographical distribution of the animals. One skeleton was taken at Flagler and another at Canyon City. The Flagler specimen was exposed for sixteen feet, the vertebral column containing ninety vertebræ. There were also taken portions of the head and paddles. Flagler is situated in the St. Pierre Cretaceous in all probability. The specimen, not yet named, has a massive jaw and teeth, the latter very compressed. The vertebral column is one of the most complete yet unearthed. The tail is particularly fine, and gives a good impression of depth and compression.

Williston thinks that the food of the sea-serpentlike saurians must have consisted of fishes of moderate size, with occasional victims of their own kind. He says: "While the flexibility and loose union

of the jaws undoubtedly permitted animals of considerable size to be swallowed, the structure of the thoracic girdle would not have permitted any such feats of deglutition of which the python and boa are capable. The animals must have been practically helpless on land. They were not sufficiently serpentine to move about without the aid of limbs, and these were not at all fitted for land locomotion. They lived in open seas, often remote from the shores. Their pugnacity is amply indicated by the many scars and injuries they received, probably from others of their own kind."

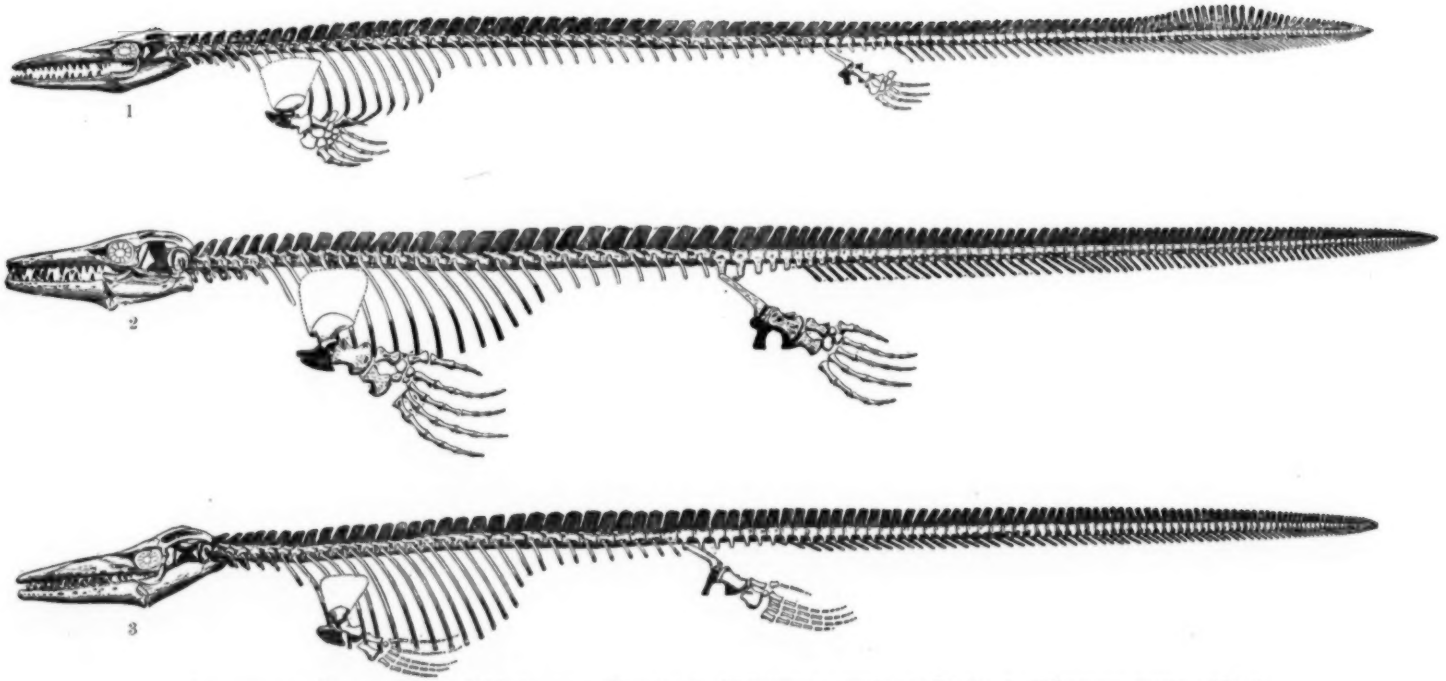
Among the fishes which were the prey of mosasaurs was *Portheus molossus* (Cope), the most formidable, and whose bulldog teeth and looks indicate that it leveled matters of justice by capturing smaller mosasaurs at times. The head of molossus was twice as large as that of a grizzly bear, the jaws deeper in proportion to length. The muzzle was stouter and deeper than a bulldog's. The teeth had sharp, cylindric fangs, smooth and glistening and of irregular size. Occasionally the teeth projected three inches above the gums, sinking one inch into the pits, as long as the fangs of a tiger and more slender. Two pairs of these long fangs crossed each other on each side of the snout.

Over the water were the flying saurians of formidable proportions, and which may have been both pursued and pursuer, according to size of mosasaur and pterosaur. The pterosaur had a wing expanse of eighteen to nineteen feet, as instanced in *Ornithostoma umbrosum* (Cope), the largest in size, and *O. ingens* (Marsh). The pterosaurs flew with leathery wings over the waves, plunging to seize unwary fishes or perhaps to be seized by mosasaurs, or soaring at a safe distance while watching the combats of swimming saurians. At nightfall they trooped along the shores, at last to suspend themselves to the cliffs by the claws of their wing limbs.

If tortoises were food for mosasaurs, there were plenty of marine turtles to choose from. The turtle was the boatman of the Cretaceous seas. The *Protostega gigas* (Cope), figured herein from a drawing by Prof. E. C. Case,* of Wisconsin, was the largest, its flippers having a spread of fifteen feet. Wieland has recently described an immense species, *Protostega ischyros*, from Wyoming.

Inasmuch as the earlier skeletons of mosasaurs were so incomplete as to leave the matter in doubt, it is interesting to note Professor Williston's discoveries of quite perfect fore and aft paddles of mosa-

* Professor Case, the authority on this marine turtle, says: The skin must have been smooth and leathery, with supporting ridges or folds of dorsal integument to strengthen the back, perhaps two or three on either side of the central ridge. The back must have been quite flat. There were no claws on the front foot. The skull was as represented in the drawing.



SKELETONS OF MOSASAURS: 1, *Clidastes velox* (Marsh); 2, *Platecarpus coryphæus* (Cope); 3, *Tylosaurus proriger* (Cope).

saurs, and the fact that marine saurians had scale-covered skins. The paddle was formerly a matter of conjecture, and, in the absence of such remains, the saurians were supposed to have had marine turtle-like flippers. Prof. O. C. Marsh, of Yale College, was the first naturalist to discover sufficient of the missing parts of skeletons to determine that marine saurians propelled themselves with paddles rather than flippers. As to the scales and skin found perfectly preserved by Snow, they do not differ materially from those of the Old World lizards, the monitors, existing to-day. The paddles, skin, and scales are very delicate functions, and it is remarkable that they should have been preserved through millions of years. Williston says of the paddles: "The specimen figured by Chancellor F. H. Snow, of the University of Kansas, has been thoroughly cleaned from the matrix, enabling an accurate drawing to be made, also a photographic reproduction as it lies on a chalk slab. The parts concealed beneath the ribs and vertebræ have been carefully laid bare from the opposite side and their position shown. The position of the paddle is a natural one, and the fact is of interest as showing the general expansion and curvature of the digits." The limb is very flexible, with considerable space between the bones, which were but partly filled out with cartilage, and must have had very free articulations. The remains of the skin were found between the bones, indicating a thin, pliable membrane, and extending fully between the fingers to their tips. Small scutelike scales extended as far as the metacarpals. The fifth finger is long. The paddles are slenderer, more flexible, and relatively longer than in other genera, which, with other characteristics, would show that *Tylosaurus* was the least lizardlike of the *Pythonomorpha* (Cope). As to the structure of the hind paddle, it is of interest in having five functional toes, although Williston thinks that the fifth toe was undergoing reduction, and that the first toe was not as long as in the front paddle. He concedes five toes to the hind paddle of *Platecarpus* (Cope), but doubts, in the absence of a complete skeleton, if *Clidastes* had more than four functional toes, as in *Mosasaurus*. Upon this character, together with the absence of a sternum, he has established two families, *Tylosauridæ* and *Mosasauridæ*, and the two typical genera, representing the extremes of development of this order of reptiles.

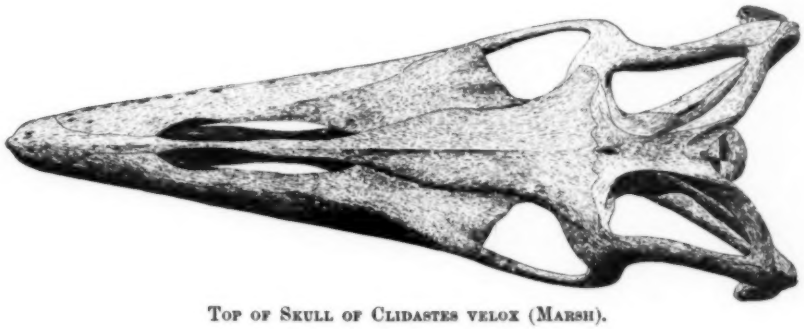
Mosasaurs are known to have existed in many parts of the world, New Zealand, North and South America, and Europe, the oldest being regarded as the New Zealand types, *Liodon* and *Taniwhasaurus*. Dollo thinks that New Zealand was the center of their irradiation, where they appeared in the end of the Cenomanian,* to appear in America in the Turonian,* whence they migrated to

* Subdivisions of the Cretaceous formation.

Europe and appeared in the Senonian,* and finally became extinct there in the Mæstrichtian.* They also have been reported from South America in the Purus * of the Amazon, corresponding to the Mæstrichtian * times. Professor Marsh's *Baptosaurus* appears to be the last of the American forms, found in the Upper Green Sand * of New Jersey and the Niobrara * of Kansas.

In this connection it is interesting to note the views of certain scientific men of the times in which these gigantic sea serpents existed.

The views of Prof. Frank C. Baker, curator of the Chicago Academy of Sciences, follow: "At the time the great sea lizards lived, North America was shaped something like the following: It



Top of Skull of Clidastes velox (Marsh).

included all of northeastern Canada and Nova Scotia; the shore line was the same as at present as far as New York, where it was deflected to the southwest and went through the western part of New Jersey, Delaware, and Maryland, and then went directly across the middle of Alabama, north again to the mouth of the Ohio River where it meets the Mississippi River, then north into Iowa, and finally north and northwest across the United States and British America. Herein existed a great inland sea in which the sea lizards lived. The past history of the world tells us that thousands of animals of gigantic size lived in the ancient seas. In old Jurassic and Cretaceous times we had such queer combinations as *Ichthyosaurus* (or fish lizard) and *Plesiosaurus*. Not only were reptiles found in the water; they flew about in air. The latter were represented by the *Rhamphorynchus*, a birdlike reptile which had wings like a bat, teeth like an alligator, and the tail of a lizard. In the Connecticut Valley we find the footprints of huge reptiles in the red sandstones whose feet measured from those of a few inches in length to the footprints of the gigantic *Otozoum*, which measured twenty-two inches in length, having a step of some five feet."

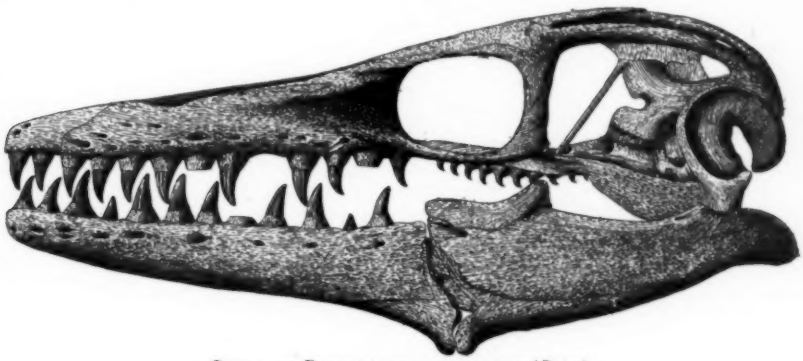
* Subdivisions of the Cretaceous formation.

An immense amount of literature has been printed on the subject of the Cretaceous formation and its inhabitants. Very recently there have been immense advances made in the restoration of species existing in Cretaceous times. This article, therefore, is in the nature of scientific news, and a separation of facts from a mass of errors. In looking over the works of others, one is impressed by the many mistakes made by specialists, owing to imperfect skeletons and collections. A careful study of these errors has been made in the light of the latest skeletons reconstructed and the latest discoveries made.

The Kansas University, in securing three perfect type specimens of three genera of mosasaurs, presents three important items of scientific news. These skeletons teach us the errors and pitfalls into which specialists have fallen who lacked certain parts of the skeletons and filled out the gaps by aid of the imagination. Only recently the country was startled by the alleged discovery of the skeleton of a supposed reptile, having a length of two hundred and fifty feet. The newspapers gave startling pictures of the supposed appearance of this reptile while on earth. Professor Williston naturally wanted to see this gigantic animal, the largest ever discovered. On examination of its bones he saw at once that it was a whale. It can safely be asserted that no animal ever attained a length of two hundred and fifty feet. Perhaps as serious errors as this may be found in many of our text-books and monographs, due, of course, to former incomplete skeletons. The appearances of the skulls, the jaws, and the teeth have been painfully distorted in like publications and on charts in class rooms, and demand a thorough overhauling before our youth are further taught errors. With late complete discoveries, we have now exact appearances of the functions of the heads from which we can derive correct views. It was formerly thought that the eyes of the mosasaurs were directed upwardly; to-day it is known that they were directed laterally, as in living lizards. It has been supposed that mosasaurs attained a length of one hundred feet; no skeleton has been found which would show a length of more than fifty feet. The great majority of skeletons taken range from sixteen to twenty feet in length. It was formerly supposed that mosasaurs had the powers of running, springing, and climbing on land; it is now known that they were wholly confined to salt water, and merely climbed the beaches in order to lay eggs. It is not an easy step from mosasaurs to modern snakes; it is an utter impossibility. Professor Marsh formerly thought, and it has been taught in the class rooms, that the bodies of mosasaurs had bony scales; they had skins, and were scaled throughout like modern lizards and snakes. The *Rhamphorynchus* has been held up to us

as a "lizardlike bird"; it was no more like a bird than is a bat; it was a birdlike reptile. These suggestions certainly point to the necessity of a revision of the text-books and charts in use in class rooms, which in many instances should become obsolete because of perfected restorations.

Specialists regard the marine saurians as having existed some millions of years ago. They conclude that these animals had at least a million years of existence in various forms. While it may be ventur-



SKULL OF PLATECARPUS CORYPHÆUS (COPE).

ing into the domain of the encyclopædia to state the causes of these conclusions, a word here may not be out of place. The Cretaceous formation, in which the marine saurians are found, is of chalk, green sands, etc., and ranges in thickness from ten thousand to twenty thousand feet or more. It existed in the last part of the Mesozoic realm. From the thickness and position in geological strata scientists deduce its age and place in Nature. As the remains of marine saurians are found only in the Cretaceous deposits, specialists speak of them as existing several million years ago. At that time were numerous fishes, birds, reptiles, and plants.

On previous pages some remarks have been passed in reference to origin and distribution of the sea saurians. It may not be out of place to exploit further the evolution and sequence of other saurians existing before and contemporaneously with the salt-water group. To do so in a brief way presupposes that the reader has some general knowledge of the times in which these remarkable animals existed. The evolution of animal life can only be discussed in general terms, as completer skeletons are needed to determine the whole subject.

The duration of saurians extended from the Carboniferous period of the Palæozoic realm through the entire Mesozoic realm which followed. The original saurian, so far as discovery to date shows, was a cotylosaur, found in the coal measures of Ohio by the late Professor Cope. This ancestor, *Isodectes punctulatus* (Cope), was eight

inches in length, resembling somewhat the farm-fence lizards of to-day. In the Permian era, closing the Pelæozoic realm, other cotylosaurs appeared in numbers, first of moderate size, then gradually increasing in bulk. Of these were the larger *Theromera*, such as the lizardlike *Dimetrodons*, some with forty-inch spines on their backs, and the shell-backed, lizardlike *Otocœlidæ*, the ancestors of the marine turtles (*Testudinata*), ranging from three to ten feet in length. The Mesozoic realm, following, was the most extraordinary period of earth for its forms of animal life. In its first section, the Triassic, the saurians that appeared assumed wide orders, functions, and greater proportions. These lizardlike saurians were termed *Palæoctonus*, *Ætosaurus*, *Dystrophacus*, *Thecodontosaurus*, and *Palæohatteria*.

The Triassic, Jurassic, and Cretaceous formations, following, formed the most remarkable period of types of animal life. An examination shows that the marine Jurassic beds of Colorado were overlaid by a former fresh-water area, or lake, in which abounded iguanodons, megalosaurs, and cetiosaurs of diverse species, which swarmed in vast numbers and grew to gigantic proportions. The forests and jungles abounded in saurians which walked upon four legs and were so armed as to preserve peace while they fed on vegetation. The Cretaceous agathaumas resembled somewhat in form the rhinoceros, and the Jurassic stegosaur partook of the bulk of the elephant.

UNDER SIDE OF SKULL OF TYLOSAURUS PRORIGER (COPE).

Agathaumas had a powerful skull, with two long horns over the eyes pointing upward and one over the nose pointing forward. The stegosaurs had a wonderful dermal armor of plates and spines arising along the spinal column. Such were the more specialized types of the forest. The plains and fields swarmed with saurians which ran or leaped on two hind legs and tail, tripod fashion, and whose fore limbs were used for seizing prey or supports. Those of the kangaroo type are represented by the Laramie Cretaceous *Lælaps incrassatus*

(Cope), which preyed upon the Western *Hadrosaurus mirabilis* (Leidy), and the Cretaceous *Lælaps aquilunguis* (Cope) of New Jersey, which preyed upon the Eastern *Hadrosaurus Foulkii*.

The lakes were infested with saurians which waded or swam, either or both. These types are represented only in the Jurassic. The *Amphicœlius altus* (Cope) was one of the largest of dinosaurs, which waded but never swam. It traveled mainly on the bottom of the lakes, raising its long neck and head occasionally to browse upon the overhanging branches, but never venturing ashore, where its weight would have caused a collapse of its structure. It doubtless could not swim. Amphibious and omnivorous, it ate everything edible it could reach or seize—a saurian in structure, everything in habits.

The Cretaceous ocean teemed with the serpentlike saurians which form the subject of this article. With the Mesozoic realm terminated the period of existence on earth of all the large saurians. In the following Cenozoic realm their successors appear in the diminutive saurians, snakes, and crocodiles.

PEACE AS A FACTOR IN SOCIAL AND POLITICAL REFORM.

By FRANKLIN SMITH.

ONLY by the application of an induction of Herbert Spencer, hardly less important and brilliant than his law of evolution, is it possible to introduce order into the complex and obscure phenomena of social and political life, and to distill from them trustworthy guidance for human conduct. In the light of the truth that out of the conflicts of war come one set of thoughts, feelings, and institutions, and out of the pursuits of peace come another set entirely different, the complexity and obscurity pass away. To the former we can trace with unerring certainty and precision the intolerance, brutality, dishonesty, and despotism that afflict the world; to the other, the enlightenment, forbearance, integrity, and freedom that give promise of a better day. But because of the flagrant disregard of this truth, not only by the ignorant and demagogic but by the literate and philanthropic, there is the gravest danger of a loss of the achievements of civilization and a restoration of the evils of barbarism.

I.

The facts in support of the militant origin of barbarism and the pacific origin of civilization, like the facts in support of any other

induction of science, be it in physics or astronomy, are not new. They are to be found in every volume of history, whether ancient or modern, narrative or analytical, and when once pointed out thrust themselves into consciousness with resistless force. Not otherwise could it be. The historian that sought to transfer to his pages the phenomena of social and political life in any country or age could no more fail to contribute the data that enabled Mr. Spencer to frame his induction than the physicist and astronomer that contributed to Newton's great achievement. When he described a war, he had to describe the butchery, plunder, devastation, and degradation it entailed; he had to note the enlargement of the power of the monarch or oligarchy that carried it on with the most success. When he described the return of peace, he had to describe the revival of industry and prosperity; he had to note the impatience of the people under the restraints that the necessities of conflict always impose, the refinement of their feelings, manners, and tastes, the growth of their intelligence in depth and breadth. But only a mind unusually skilled in the art of interpretation could grasp the significance of these varied phenomena, and bind them with the indissoluble bond of an immutable law of social life.

Now that Mr. Spencer has done this memorable service for science, it is possible for minds of less power and originality to scan the pages of history, and to observe for themselves the play of the forces that make for barbarism. As they follow the path that he has blazed, they will see that nothing could be more obvious than the relation of cause and effect between the ravages of war and social degeneration. The very word war, which General Sherman once defined as hell itself, conjures up a picture of economic, social, and moral devastation that does not require the aid of poets or orators to heighten. The avowed object of this form of human activity is destruction pure and simple—destruction of property and destruction of life. The obvious corollary is the destruction of everything in the social fabric that conserves either life or property—freedom, honesty, virtue. Most vividly does Motley, who had no social theory to defend, bring out the truth in his story of one of the fearful raids of Alva in the Netherlands. "The page which records that victorious campaign," he says, speaking of the attack on Groningen at the opening of the struggle with Spain, "is foul with outrage and red with blood. Not one of the horrors which accompany the passage of hostile troops through a defenseless country was omitted. Maids and matrons were ravished in multitudes; old men butchered in cold blood. As Alva returned with the rear guard of his army, the whole sky was red with a constant conflagration; the very earth seemed changed to ashes. Every peasant's hovel, every

farmer's house, every village upon the road had been burned to the ground." The histories of all the wars ever fought are only variations of the same hideous theme. However much they may be studied, they can not be forced to yield a profounder secret.

Out of the devotion of all the resources of society to the sole object of destruction spring momentous and far-reaching consequences. One of the most important and conspicuous is the creation of a powerful central authority to wield the resources of society, and the pursuit of a policy at home and abroad that shall insure the most effective use of those resources. Never was a war fought that did not bring into existence a strong executive, or make still stronger the executive already in existence. Troops must be raised and commanded; taxes must be levied and collected for their support; all needful political machinery must be created to facilitate both. Only one man, like Cæsar, Frederick the Great, or Napoleon, or a very small body of men like the Spartan ephors or the Venetian Council of Ten, aided by obedient subordinates, can do such work. It was in unconscious recognition of this fact that the liberty-loving Dutch, when hard beset by the forces of Spanish bigotry and despotism, turned instinctively to the Prince of Orange. Had he accepted and exercised the authority that they urged upon him, he would have been as autocratic as Philip II. In obedience to the same pitiless law of militant activity, the opponents of the despotism of Charles I fell under the despotism of Oliver Cromwell. That it has not ceased to operate in times much more recent, there is ample proof in the records of the civil war. By the stress of that conflict, Abraham Lincoln was forced to exercise an authority in shocking disregard of the principles of American freedom. Even the violence of the great strikes in the last few years has led to a strengthening of the hands of the executive that has evoked the severest criticism.

The law that despotism, like the destruction of life and property, is an invariable product of war, is as immutable as the law of gravitation or the persistence of force. It is as potent and universal in the interpretation of the phenomena to which it applies as either in the interpretation of the phenomena to which they apply. True of every age, of every country, of every people, it throws a light upon constitutional history that shines from no other quarter. Flooded by its powerful rays, the cause of the destruction of the Roman Republic and the establishment of the Roman Empire becomes a commonplace. The incessant wars of the Roman people could have produced no other effect. It is obvious, too, that feudal despotism was only the natural product of mediæval disorder. "Royalty," says Guizot, reaching out feebly after the law that Mr. Spencer alone has firmly grasped, "is admirably adapted to epochs

of vigorous and fruitful anarchy . . . when society desires to form and regulate itself, without knowing how to do so by the free concord of individual wills." After the long and bloody wars of Charles V and Francis I, so quickly succeeded by the more ferocious and devastating wars of the Reformation, the universal extinction of freedom in Europe was inevitable. "The traditional liberties perish," says Guizot again, summing up the history of the period, "and new and more concentrated and regular powers arise." These powers were, of course, the powers of despotism—the powers that became most completely personified in Louis XIV. Hardly had they begun to yield to the emancipating influences of peace before the Napoleonic wars came to give them new life, and to fasten upon Europe a despotism that required the Reform Bill in England and the revolutionary movement on the continent to weaken and partly overthrow. But with the Crimean War and the other great contests that followed so quickly, there has been a return to despotism again, particularly in France and Germany.

Like a powerful poison, the despotism called into existence by war diffuses itself through every part of the social fabric. Upon the penalty of defeat or extinction, society must be so organized politically, industrially, and ecclesiastically as to enable the central authority to summon to its aid every resource with the least possible delay. The organization best adapted to this purpose is the organization of feudalism. At the head of the nation stands the despot himself; over each great division, a prince or duke; over the lesser divisions, the counts, viscounts, and barons; finally, there is the great mass of people, whose duty it is to provide without complaint or protest the soldiers that constitute the army and the means to sustain them in the field. Hence the quickness of the movements of Francis I compared with those of Charles V and Henry VIII. "Before his enemies were ready to execute any of their schemes," says Robertson, bringing out the superiority of a despotic organization of society over a condition of popular freedom, "Francis had assembled a numerous army. His authority over his own subjects was far greater than that which Charles and Henry had over theirs. They depended on their diets, their cortes, and their parliaments for money, which was usually granted them in small sums, very slowly and with much reluctance. The taxes he could impose were more considerable, and levied with greater dispatch; so that . . . he brought his armies into the field while they were only devising ways and means for raising theirs." What was true of the great struggle between these potentates is true of every other. The nation most perfectly organized, other things being equal, will be the most successful in war.

To war, therefore, and not to the wisdom of philanthropists, may be traced all those regulations of industry and commerce that have cursed and still curse every civilized nation. It was the author of customhouses, of cruel taxes, like the taille and gabelle, and of all the licenses and monopolies ever invented. While the plunder of enemies often contributes, as it did in the case of the Romans, to the military chests of a nation, it is upon the taxation of industry and commerce, a form of internal aggression always accompanying the external aggression, that the despot must depend for certain and definite revenues. To make sure that both are conducted in a manner most advantageous to himself as well as to his subjects, he assumes the right to regulate them. Since the exportation of commodities would diminish his own supplies and increase those of his enemies, he prohibits it; since their importation would drain his kingdom of the precious metals, indispensable in war, he prohibits that also. "Considering that our enemies might profit by our provisions and it is important to leave them their merchandise," said St. Louis, "we have ordered that the former shall not be exported nor the latter imported." Sometimes industries fall under the blight of royal protection because they provide commodities useful in war; sometimes, to make the state independent of supplies that might be cut off by war; sometimes, to establish monopolies to get the ready money required in war; sometimes, to stimulate production in order to make easier the burdens of war; sometimes, as was once proposed in France in regard to the silk industry, to prevent a form of toil that might unfit men for war. But whatever the regulation or the industry regulated, it is always war that gives the first impulse to this exercise of despotism, and the more a country is given up to war, the more despotic the regulations. It was so in Spain, where those of Charles V and his successors ruined industry; it was so in France, where those of Boyleau, Sully, and Colbert paralyzed industry; it was so in Germany, where the Great Elector and the other princes pursued the same ruinous policy. Only in England and Holland, where despotism throve the least, did industry thrive the most.

War also is the origin of those distinctions of society based, not upon character and ability, but upon occupation and birth. As long as it was the chief or only pursuit of man, it was the only calling of respect and honor. All other pursuits were more or less ignoble and debasing. Soldiers fight and die for their country. Only slaves work. Toilers, consequently, become objects of scorn and contempt. Not even philosophers were able to rise above the prejudices born of war. "Nature," said Plato, describing the inhabitants of his ideal republic, "made neither shoemakers nor blacksmiths. Such occupations degrade the people that engage in them. . . . As to

tradesmen, accustomed to lie and deceive, they will be suffered . . . only as a necessary evil." In the opinion of Xenophon, "the manual arts are infamous and unworthy of the citizen." Cicero believed commerce to be "a sordid affair, when it is of little consequence," and "only tolerable at best, when conducted on a large scale and to supply the country with provisions." Despite the maxim of the monks, *Laborare est orare*, the same vicious views prevailed during the middle ages. In the militant countries of to-day, especially Russia and Germany, they have hardly begun to pass away. But the forces that operate to divide a nation into warriors and workers operate also to divide each into other classes. Not only is there a hierarchy of the nobility, but also an ecclesiastical and industrial hierarchy. If we have princes, dukes, counts, and barons, we have cardinals, bishops, canons, and the minor clergy. Above the slaves and serfs there are various trade and professional guilds, where pride of occupation seeks to make hereditary the barriers it has raised. To emphasize these distinctions in state, church, and industry, to enable the members of one class to observe the deference due the members of another, titles, costumes, decorations, and the other insignia of rank are invented and made obligatory by law.

The despotism that cramps and paralyzes social activity, cramps and paralyzes intellectual activity. In the first place, the necessities of war make it impossible as well as useless to give thought to matters that do not contribute to success in battle.* Therefore, the Spartans had neither literature nor philosophy—neither science nor art. Pursuit of these subjects was effeminate; it unfitted men for the better business of fighting. "Instruction in the sciences," said the barbarians that conquered Rome, anticipating a favorite opinion

* Did space permit, it would be pertinent to show at some length how war diverts attention from all subjects not related to it, and how, even when it does not divert attention from them, it colors them. But any student of sociology will discover abundant proof of this truth in the phenomena growing out of the war with Spain. Take, for example, the New York Evening Post of Saturday, May 7th, a newspaper that was opposed to the war in its inception and does not favor it now. But it has been forced to yield to the war spirit to such an extent that of the four leading articles on the first page of the supplement, especially designed for general family reading, three relate to war. On the second of the news pages will be found another long article on "the signs of its (war's) permeation of city life," showing how even "confectionery and embroidery (are) affected." On the editorial page will be found still another article on War Books, showing in like manner that the effect of the war on the publishing business "is depressing," and that while "books old and new about Spain and Cuba, about strategy, and the navy and sea power, manuals for the naval reserve, works on tactics are firm to higher, as the market reports say," "*belles-lettres*, criticism, history, essays, even the novel, are flat and weak, if not stale and unprofitable." Indeed, the student will find in the phenomena in question, including the bitterest intolerance and a startling perversion of the moral sentiments in regard to the taking of life and property, a complete verification of all the principles that I have set forth in this section of my article.

of Old Fritz of Prussia, "tends to corrupt, enervate, and depress the mind. He who has been accustomed to tremble under the rod of the pedagogue will never look on the sword or spear with an undaunted eye." In the second place, the pursuit of studies and the growth of beliefs not in conformity with those in honor with the central authority, would provoke discord, and, as in the case of Charles V and Henry VIII, make it more difficult to mobilize and wield effectively against an enemy the resources of society. Not only must the political opinions of subjects be those of the monarch, but there must be adhesion also to his religious beliefs. That was the contention, for example, of Philip II and Louis XIV. To dissent from them was to be guilty of treason; it was to merit death. Hence the paralysis of the French and Spanish intellects that Buckle describes. Hence the rigid censorship that prevails to-day in Germany and Russia and also in Turkey and Persia. It was war, therefore, not religion, that produced Torquemada and the Inquisition, that led to the massacre of St. Bartholomew, the persecution of the Dutch, the extinction of the Albigenses, and the perpetration of all the other crimes committed in the name of Christianity. The same truth explains also the check to Protestantism after the outbreak of the wars of the Reformation and the revival of Catholicism in all the countries that remained loyal to Rome. When we remember that war is the parent of despotism, and despotism the parent of intolerance, we can understand, too, why Protestantism repudiated its allegiance to the principle of private judgment, and like its rival resorted to the rack and fagot to keep the minds of men in subjection.

"I should be content," said Frederick the Great during the most trying period of the Seven Years' War, giving a clew to the origin of the moral evils of society, "if I could only first inflict a part of the misery I endure." Since the first object of war is destruction of life and property, anything that promotes this end is right. Indeed, it is not only right, but it is noble. "They boast," says Ammianus Marcellinus, alluding to the Huns, "with the utmost exultation of the number of enemies they have slain, and as the most glorious of all ornaments they fasten the scalps of those who have fallen by their hands to the trappings of their horses." If enemies can be deceived by false statements or sham movements and lured into a trap for easier and safer slaughter, it should be done. If they become prisoners, they should be killed or enslaved. If their wives or daughters are ravished or consigned to a harem, it is only an exercise of legitimate rights over the persons of the conquered. If their property can not be carried away and its further use in resistance to attack prevented, it should be burned. "The northern invaders," says Macaulay, describing the condition of the Italians during the

invasions of the French, Spanish, and German armies, "had brought want to their boards, infamy to their beds, fire to their roofs, and the knife to their throats." But there was never a people that practiced the ethics of war against their enemies that did not practice the same code against themselves. The members of the upper classes prey upon the members of the lower, and the members of each class prey upon one another. Everywhere there are deceit, baseness, cruelty, and every crime of violence. "No language," says Draper, speaking of the condition of Rome, "can describe the state of that capital after the civil wars. . . . The social fabric was a festering mass of rottenness. The people had become a populace; the aristocracy was demoniac; the city was hell. No crime that the annals of human wickedness can show was left unperpetrated—remorseless murders; the betrayal of parents, husbands, wives, friends; poisoning reduced to a system; adultery degenerating into incest, and crimes that can not be written." But a like demoralization was the fruit of the civil war in England and the long wars in France, Germany, and Italy. It is not, therefore, at the door of Adam but at the door of Mars that the sins of the world are to be placed; they are not due to the fall in Eden but to the plunder and murder on the field of battle.

II.

Thus far I have indicated how war leads directly, inevitably, and invariably to despotism in government, ignorance and intolerance in political and religious thought, and crime and degradation in social life. Let me turn to the fruits of peace, which include all that constitutes civilization. The connection between the two is likewise direct, inevitable, and invariable. Wherever peace stays the hand of destruction and resumes the work of creation, forces are put in operation that transform the thoughts and feelings as completely as they transform the pursuits, manners, and institutions of men. Released from the burdens and insecurity of war, society, like a body delivered from the fever and waste of disease, revives and grows strong. Industries flourish. Pressing against the cords with which the state and church have bound them, they pant and struggle for freedom. The mind responds also to the new life. Becoming enlarged with the enlargement of its activities, it refuses to submit to the bondage in which political and ecclesiastical despotism has placed it. It insists upon exploring every nook and corner of the universe and bringing to light every discovery. It rejects traditions and superstitions, and proceeds to construct the splendid edifice known as modern science. At the same time, it manifests its joy in creations of the imagination—poetry, music, painting, sculpture, architecture. These pursuits of peace introduce new relations among men. Indus-

try and commerce make it necessary for them to approach one another, not with a dirk or spear, but with the hand and look of welcome and friendship. Thus manners become more gentle, and feelings more sympathetic. There is a better recognition of rights and obligations. With a better recognition of rights and obligations pass away the slavery, deceit, vice, crime, and other evils that war engenders.

Like the deductions from the ruin of war, these deductions from the recuperation of peace have the sanction of historians that never heard of Mr. Spencer's social philosophy. "It is with human activity as with the fecundity of the earth," says Guizot. "With the least glimpse of order and peace, man takes hope, and with hope goes to work. It was thus with the towns," he adds, alluding to the diminution of anarchy that came with the establishment of feudalism. "The moment that feudalism was a little fixed, new wants sprang up among the fief-holders, a certain taste for progress and amelioration; to supply this want, a little commerce and industry appeared in the towns of their domain; riches and population returned to them; slowly, it is true, but still they returned." Robertson makes a similar contribution to the pacific origin of civilization. "Commerce," he says in his famous view of Europe before the reign of Charles V, "tends to wear off those prejudices which maintain distinctions and animosity between nations. It softens and polishes the manners of men. It unites them by one of the strongest of all ties, the desire of supplying their mutual wants. It disposes them to peace by establishing in every state an order of citizens bound by their interests to be guardians of public tranquillity. As soon as the commercial spirit acquires vigor and begins to gain an ascendant in any society, we discover a new genius in its policy, its wars, its alliances, and its negotiations. . . . In proportion as commerce made its way into the different countries of Europe, they successively turned their attention to those objects and adopted those manners which occupy and distinguish polished nations."

An appeal to the facts of history that led Guizot and Robertson, as well as other writers ignorant of Mr. Spencer's social philosophy, to these important inductions does not impair their validity; it only strengthens them and makes them the more impregnable. Wherever peace can find a refuge from the violence and uncertainty of war, industry and commerce take root and work their miracles. No matter whether it find protection on the slopes or in the valleys of mountains, among the sand dunes or in the marshes of the sea, behind the walls of a city or away from the path of marauding invaders, the result is the same—civilization. Had not the Dutch been able to escape from the anarchy beyond the borders of their barren and in-

hospitable land at the mouth of the Rhine and the Scheldt, no Motley would have had occasion to write the history of their immortal republic. It was because the Alps furnished protection from the barbarians that plundered the adjacent countries that the Swiss became famous in the history of freedom. But for the lagoons of the Adriatic barring the advance of foot and horse, the world would never have heard of the Venetians, who maintained their state for more than a thousand years. The populations in all the countries of Europe, especially those of northern Italy, where modern civilization made its earliest and most glorious conquests, that were able to raise a wall against the floods of disorder that raged about them, soon passed from the shadows of barbarism, and only returned to them again because of the ferocity of political dissensions and the devastation and degradation of war. In southern France, where Roman civilization suffered least from the inroads of the barbarians, the people became much more enlightened and civilized than in northern France, where it suffered most. The energies of the northern boroughs were devoted to a struggle with feudalism, and, as a consequence, municipal freedom and civilization made little headway. Those of the southern were devoted, to use the words of Guizot, to "internal organization, amelioration, and progress." The inhabitants thought only of establishing "independent republics."

As here implied, peace is the progenitor of political freedom. It destroyed the monopoly of power enjoyed first by the one and later by the few, and conferred upon the many a voice in the control of their lives and property. The pacific states of antiquity were free states —Athens, Corinth, Rhodes, and Carthage. The industrial populations that escaped the anarchy of the middle ages were also free. When war ceases to be the main business of life, there is a relaxation of the bonds of despotism. They are not required to resist aggression nor to promote it. By useless and vexatious regulations they interfere with production and exchange. Moreover, a people trained to the management of their private enterprises, learn to manage public enterprises and demand a share in the work. The genius shown by the Dutch in the art of self-government was acquired during the centuries that they were left to themselves and their industries. The charters granted to them by their rulers conceded nothing new; they confirmed only the prescriptive rights and privileges evolved from industrial needs. The free governments of Venice, Barcelona, and other industrial cities of Europe, particularly those of the famous Hanseatic League, had a similar origin. "The cities are the work of the traders," says M. Pirenne, an eminent Belgian scholar; "they exist only because of them. Whether of Roman or non-Roman origin, seat of a bishop, monastery, or castle, free or subject to the

law of the demesne, they began to acquire a municipal organization only at the moment when, along with the primitive population, a foreign population became established that maintained itself by industry and commerce." Because of the absence of the fighting populations of Europe during the Crusades, the pacific and industrial populations left behind gained the strength and wealth that enabled them to break the chains of feudal despotism, and to purchase the liberties that make the fourteenth and fifteenth centuries the gateways to modern civilization. It was after the slow recovery from the devastating wars of the sixteenth and seventeenth centuries that the agitation in behalf of freedom ended in the terrific explosion of the French Revolution and the restoration of the rule of the despots. Again, it was after the long peace following the Napoleonic wars that the agitation was renewed, and, in England, led to the passage of the Reform Bill, and, on the Continent, to the demand for popular constitutions.

Peace is also the progenitor of intellectual freedom. The forces that shattered the despotism of the autocrat and aristocrat shattered the despotism of the ecclesiastic. Since the power of the latter grew out of the same conditions that produced the power of the former, the establishment of the new conditions was certain to be fatal to both alike. As soon as men began to think and act for themselves in industrial matters, they began to think and act for themselves in ecclesiastical as well as political matters. Accordingly, we find everywhere that the revolt against the church as well as the state started in the industrial centers. "In European history," says Thorold Rogers, "discontent with existing religious institutions and the acceptance of heresy on speculative topics have always been characteristic of manufacturing regions. It was the case in Toulouse in southern France, in Flanders, in eastern England. The French Huguenots were the manufacturers and merchants of the country in the seventeenth century, and when they were expelled carried with them their skill and capital. Only Italy is an exception," he adds, "and Italy profited so greatly by the papacy that it was not disposed to quarrel with the institution, although it had no love for the representative of it." The era of comparative peace that began with the establishment of feudalism and the opening of the Crusades and ended with the conflicts between Charles V and Francis I gave a powerful impulse to industry and commerce, and these again to the human intellect. Without the cessation of the anarchy that followed the downfall of Rome, the awakening of the minds of men that flowered in the Renaissance and the Reformation would not have been possible. But before they could gain their freedom, the mediæval conception of the duty of the individual toward the polit-

ical and ecclesiastical powers, intertwined almost inextricably, had to be overthrown. All the theories of Nature and society, all the absurd and hideous superstitions that disgraced the mediæval intellect, had to be modified or destroyed. To prevent such a revolution, which was certain not only to wipe out the moral abuses but to reduce the enormous power and revenue of the state and church, the fiercest conflict of modern times was precipitated. Although the battle was a drawn one and brought about a reversion to intellectual and political despotism, the human mind was not destined to be reduced to its old enslavement. It had made acquisitions in freedom and knowledge that subsequent wars, subversive as they were, could not take away.

The social revolution that accompanied the action of the forces set in operation by peace and industry was as great and far-reaching as the political and intellectual. It swept away that vast, complicated, and artificial system of class distinctions that prevailed in every feudal country. Birth ceased to be the only title to rank, and the profession of the soldier the only profession of a gentleman. The creation of wealth outside of land, which was the only form of property that could not be destroyed or carried away, brought a new standard of social worth into the world. Other pursuits besides the noble one of murder and pillage established a claim to social consideration. Men of character and ability engaged in industrial and professional occupations began to rank with the warrior and noble. Merchants, bankers, and lawyers that rose to wealth and eminence received the same honors that were bestowed upon men that won renown on the field of battle. Like the Fuggers in Germany and Jacques Cœur and Jean Ango in France, they became the friends and confidants of kings and princes. "Louis XI, like Charles VIII," says Pigeonneau, "surrounded himself with men of the middle class; he knew that they had more special knowledge, more docility, more fidelity, 'because they could not outrank him.'" So great was the esteem in which industrial pursuits were held in the Netherlands that even Philip II created the Order of the Golden Fleece to reward the men that had achieved eminence in them. Alarmed at the havoc that industrialism was working with the social hierarchy in France, the Duc de Sully, the chief minister of Henry IV, complained that "the confusion of ranks" and "the degradation of people of quality" were among the evils that endangered the monarchy. As early as the reign of Francis I, which had been preceded by the great outburst of national prosperity that followed the close of the Hundred Years' War, a similar complaint had been made. "Because of the opulence and peace that prevail in France," says a writer of the time, "the pride of all classes has increased more and

more. . . . The bourgeois of the cities, both men and women, insist upon dressing like noblemen and ladies, noblemen as sumptuously as princes, and the inhabitants of the village like the bourgeois of the city." To prevent the political catastrophe involved in such a dangerous "confusion of ranks," very stringent sumptuary laws were enacted. But they were all in vain. The progress of peace and industry has wiped them out. In democratic countries like the United States, character and ability are the test of social worth, and the establishment of this test has abolished those distinctions of dress so important to the feudal mind.

If war makes ethical every act of destruction, peace makes ethical only acts in conservation of life and property. When men stop killing one another and undertake to supply one another's wants, a new code of morality begins to influence their conduct. As commerce brings people in contact with foreign nations, especially those known as heathen, a relaxation of religious and national prejudice occurs. Opposition to war against them springs up. Friendly relations are advocated. A grave charge brought against the Venetians, whose intercourse with other nations had made them enlightened and humane, was that they tolerated the Jews, obstructed one of the Crusades, and deprecated attacks upon the Mohammedans. A further step toward civilization is the advent of international agreements to prevent disputes and thus forestall conflicts. Here the pacific nations were the pioneers. The earliest commercial treaties extant are those of industrial Carthage with Rome. The first codifications of trade regulations were those of industrial Rhodes and Barcelona. The study of international law itself received its greatest impulse in industrial Holland. With the diminution of aggressions abroad and the growth of international jurisprudence occurred a diminution of aggressions at home and the growth of domestic jurisprudence. Courts were organized for the settlement of disputes and the punishment of crime. Here, again, the pacific nations were the pioneers. Hallam cites the significant fact that judicial combat never prevailed in England to the extent it did on the Continent. After saying that the moment a man entered the gates of one of the Italian republics of the twelfth century "he might reckon with a certainty on finding good faith in treaties and negotiations," Sismondi adds that he might also reckon upon "an energy in the people to resist by common exertion every act of injustice and violence." The militant nations were the last to abolish slavery and serfdom, and also judicial torture and the burning of witches and heretics. They were the last to cultivate commercial honor, personal purity, and the other virtues of a pacific life. Although the Dutch were often obliged during their terrific struggle with the Spaniards to raise large sums of money at a

heavy discount, they never repudiated, as did Queen Elizabeth and Philip II, a single obligation. While the Jews were most cruelly persecuted by the militant exemplars of piety elsewhere, they welcomed them. Like Athens before her degradation by war, they welcomed also every alien laborer and every product of alien industry. Protection of their own industries was a form of foreign and domestic aggression to which they never resorted in the hour of their direst needs. Among them the relations of the sexes offered the most striking contrast with those of Prussia, Italy, France, and Spain of the same period. "They hold adultery in horror," says Guicciardini. "Their women are exceedingly circumspect, and are constantly allowed much freedom. They go alone to make visits, and even journeys, without evil report." It was in industrial Holland that labor received its most generous reward, and the poor and sick their most solicitous care; it was there, too, that crime was the most rare and its punishment the most humane. Her prisons are described as more like schools than jails, and their inmates as oftener foreigners than natives. It was, finally, of this wonderful creation of peace and honest toil that Thorold Rogers said that "the debt which civilization and liberty owes" to her "is greater than that which is due to any other race."

III.

Setting forth the business of physical science, Prof. Ernst Mach says: "It endeavors by comprehensive and thorough description to make the waiting for new experience unnecessary; it seeks to save us the trouble of experimentation by making use . . . of the known interdependence of phenomena, according to which, if one kind of event occurs, we may be sure beforehand that a certain other event will occur." That is precisely the business of social science. Only as it serves that purpose has it any title to the name it bears, or any value as a guide to human conduct. By a study of social phenomena, it seeks to discover their interdependence, and then to frame such a comprehensive statement of that interdependence as to permit without further study or experiment the prediction of the results of any dominant form of social activity. But such a statement is to be found in the induction of Mr. Spencer that if the dominant activity of society be militant, the thoughts, feelings, and institutions of men will be those of barbarism; if it be pacific, they will be those of civilization; or, if there be a commingling of the two, as is now the case in Europe and America, they will be a compromise. That is to say, in proportion as society is militant or pacific, in precisely that degree will there be freedom or despotism, honesty or dishonesty, humanity or inhumanity, morality or immorality. As I have shown, no part of

society is exempt from this law. Whatever the character of the forces in operation, they will govern all classes alike; they will govern them despite the precepts of moralists, pedagogic or ecclesiastic, or the regulations of despots, autocratic or democratic.

However closely history may be interrogated, it can not be made to disclose a truth more profound or important. Yet it is one not only seldom admitted but constantly violated. With amazing perversity, social reformers close their eyes to the significance of the fact that the dominance of pacific activity since the days of mediæval disorder has slowly brought about, without particular effort on their part and often in spite of them, the social and political ameliorations that now exist. Scornful of science and impatient of delay, they refuse to act upon the commonplace that human society in the future is to be bettered in no other way than it has been in the past. Hence they do not attempt to promote the growth of the free industrial institutions of peace that have lifted society to its present level. On the contrary, they strive to promote the growth of the discredited institutions of political despotism. What the result of this policy will be requires neither experiment nor experience to tell. The law of social science, whose operation I have attempted to illustrate, warrants the prediction that it will be disastrous. For, differing in degree, not in kind, the aggressions of government are as vicious and destructive as the aggressions of conflict. Be the motive ever so noble, not the smallest sum can be taken from a man for an object he does not approve without the commission of an act as repugnant to justice as the theft of a marauder. Nor can he be forced to take the shortest step from a line of conduct, not because it violates the rights of his neighbors but because it fails to accord with their notions of duty, without enslavement. Neither can the political contests made necessary by this aggression be carried on without the discipline of an army and the ethics of devastation. When, therefore, it is proposed to revive the institutions of feudalism, the products of war, to add to the wealth and happiness of men, the products of peace, only a return to the evils that have never failed to impoverish and degrade them can possibly occur.

But the extension of the free industrial institutions of peace threatens no such disaster. They involve no aggression; they permit neither theft nor enslavement. Being voluntary organizations to which a man may belong or not, just as tastes and interests incline him, he is not forced to part with his property except in one of the ways that must prevail in all societies truly civilized—namely, by gift or contract. Although membership of an organization, no matter what it be, requires a surrender of freedom to a greater or less extent, it is not compulsory, and the rights surrendered may be resumed at

any moment. Under the *régime* of such institutions, the object of social activity is not, I repeat, the destruction but the conservation of life and property. The man seeking to supply his own wants can do so most effectively only as he supplies the wants of his fellows—that is to say, in striving for his own happiness, he must, in spite of greed or indifference, aid in their attainment to the same state of content. But the prevalence of misery about him tends to pain him as it does its victims, and only as he helps them to escape it can he do so himself. Therefore, the very necessities of existence do not simply constrain him to undertake in the myriad forms of industrial enterprise what will contribute most powerfully to his own happiness, they constrain him also to undertake in the myriad forms of charitable enterprise what will alleviate most perfectly the sufferings of those less fortunate than himself. Thus, while peace and industry compel the abandonment of every vice that leads to barbarism, they compel the observance of every virtue that leads to civilization.

What the duty of people is must now be as plain as it is simple. They should set their faces resolutely against any extension of the authority of the state. With all the strength at their command they should work to abridge as much as possible the authority with which it has already been wrongfully intrusted. Only by voluntary effort, such as is exhibited in every private industrial and charitable enterprise ever undertaken, should they attempt a solution of the problems of life. No one then will be called upon to surrender without his consent either his property or his freedom.

AMONG the extracts from the diary of Sir Andrew Crombie Ramsay, given in Sir Archibald Geikie's Memoir, is this pretty picture of a group of famous men of science at play. Ramsay was at Darwin's, and the others were his fellow-guests: "Rose betimes, had a walk in the gardens, and came in to breakfast. . . . After lunch, Forbes, Owen, Lyell, and I had a walk in Sir John Lubbock's park, and saw a number of things pleasant to look upon, in spite of a tendency to drizzling. Nice, cozy chat, too, before dinner. Darwin is an enviable man—a pleasant place, a nice wife, a nice family, station neither too high nor too low, a good moderate fortune, and the command of his own time. After tea Mrs. Darwin and one of her sisters played some of Mendelssohn's duets, etc., all very charming. I never enjoyed myself more. Forbes came to my room before going to bed and gave me a sketch of his coming lecture on generic centers. Lyell is a much more amusing man than I gave him credit for. Mrs. Lyell is a charming person—pretty, and full of faith in and admiring her husband. Mr. and Mrs. Lyell told some capital stories about America, but on the whole all tending to the honor of America. He is quite enthusiastic about it, especially in all that relates to the liberal spirit of the New-Englanders. Boston seems to be in all the world his favorite city."

LITERATURE OF THE AFRICAN NEGROES.*

By M. MURET.

THE researches of students of folklore in Africa have been directed to all branches of popular literature, and a rich collection has already been accumulated of proverbs, enigmas, songs, national legends, religious traditions, stories, animal fables, and other works. The literary merit of all this production is not very great, but it is interesting in that it exhibits certain peculiarities in character. Proverbs are especially noteworthy in this respect. They express general and simple ideas in concise form, under familiar figures, and truly represent the first instinctive effort of man in search of a literary language. The thoughts revealed in these proverbs indicate a state of mind in the blacks quite similar to ours, while the greater part of them find their counterparts in the proverbs of other races. For example, there is a saying of a tribe of the Bantu, "He who goes into a strange country will not sing a solo but a chorus," which corresponds with the European, "He who goes with the wolf will learn to howl," or, "When you are in Rome, do as the Romans do," and nearly with the Mussulman Arabian, "If you find yourself in a country where they worship a calf, pull grass and feed it." The English and French say, "God tempers the wind to the shorn lamb"; and the people of Nupe, where the ox has no tail, "God keeps the flies away from it." We say, "Don't sell the skin of the bear before you have killed it"; the Suaheli, "Don't cut the gown before the child is born." While speaking of the Suaheli we may mention one of their adages that is full of sadness and resignation: "The poor man's hen lays no eggs; if she lays them, she does not sit on them; if she sits on them, they do not hatch; and if chickens are hatched, the hawk catches them."

It is sometimes said that slavery, polygamy, and the custom of purchasing the wife have destroyed the family feeling among the negroes. The following proverbs of the Suaheli prove that this affirmation is too absolute: "Thy mother is thy second God"; "A son, even if he be deformed, is the joy of his parents"; "Who is not willing to hear his son cry will cry himself." The enigmas or riddles of the negroes are simple, like these, among many, which have been collected by the German missionaries at Hohenfriedberg, in Usambara: "There! there it is! catch it! What is it?" (answer, "The shadow"); "What house has no door?" (answer, "An egg"). Sometimes, however, riddles are presented in such an allegorical form as to become fables, like the following, which an English writer

* From an article in the Bibliothèque Universelle et Revue Suisse.

obtained from the Zulus, and which resembles Menenius Agrippa's famous apologue: "Guess this: A person is invested with the functions of a king. He does nothing; his people work for his profit, while he continues idle. He tells them what they have to do, since he sees for them. It is he who directs them to where there is something to eat, then his people bring the food to the house; but he himself does nothing; he remains the sovereign, and only deigns to help his subjects. One day they rebelled. They came to the king and said: 'You ought not to be our sovereign and to be doing nothing; we do not feel any good from your power.' He answered: 'Very well; since you will not have me for your king, I will be still and look on the ground, and it will not be long before you find out that I am indeed your king; you will fall over precipices, you will be eaten up by wild beasts, and you will starve to death because you can not find anything to eat. You will go blind if you try to fight against me.'

"Then the rebels saw indeed that he was a sovereign if he could talk that way. And they said: 'We will recognize you as our ruler so that we may live, since, if we starve to death, the royal majesty we claim for ourselves will do us no good. A man is no king if he is not alive.' So he was recognized as sovereign by all the country, and his kingdom was happy.

"He was a person who never worked, and always stayed at home. If he fell sick, all his people were in danger of starving; nobody left his house, for fear of falling into a pit; every one prayed for the recovery of the monarch, and rejoiced when he was well."

The answer to the riddle is, "*The eye.*"

Songs are abundant among the blacks, and fill partly the functions of the Greek comedies in the time of Aristophanes and of newspapers in modern states. They denounce suspected persons, glorify victorious soldiers, and abuse the enemies of the country. Sometimes the singers improvise variants and celebrate the praises of their hearers, but this very rarely happens with respect to the whites, for the negroes generally cherish a great aversion against them, and they apply satirical verses to Europeans. For example, a Hottentot pupil ridiculed his European master: "O son of a little woman—who never had milk enough—you were sent among us! The white man first examines carefully the place where he is going to sit—and only then helps you. Oh, the little man—son of a little woman—our people are sons of lions."

The songs vary much in construction according to the tribe. They consist of strophes and are generally rhymed. Among some peoples, however, the ear is gratified with a simple assonance. The musical sense is much developed among the blacks, and a European

who hears their music for the first time is annoyed, but as he becomes accustomed to it he enjoys it. Bishop Steere says that the music of a very popular song among the Suahelis resembles that of the Gregorian chants.

While the proverbs and the riddles are generally too truthful in expression to let the personality of the authors be seen in them, in the songs, on the other hand, the man appears behind his work; he relates by preference adventures in which he has been the hero—victories over his enemies or great successes in hunting.

Sometimes the author gives a pompous eulogy of himself; and even when he sings the praises of the lady of his heart he begins with proclaiming that he is no less a brave champion than an excellent poet, and declares himself ready to defend his double reputation in single combat. He takes the part of one or another of the personages he puts in the scene, and makes personal observations of his own concerning their conduct—as, for example, in mentioning some horrible crime, he says, "So it is told, but it is hard to believe that the story of such a crime can be true."

The higher classes of the blacks, as the caste of the Magi, or of the doctors and noble families from whom the members of the government are chosen, are jealous custodians of the history of the tribe and its cosmological traditions. These cosmological myths, in which are unfolded the origin of the universe, the creation of man, the entrance of death into the world, the alternations of the seasons, and other natural phenomena, undoubtedly date from a very remote antiquity; it is not certain that they have always existed in the same form they have now, but it is probable, from the veneration with which they are regarded, that they have been preserved substantially intact. They confirm the opinion that primitive mankind had a common fund of ideas which varied very little in different places; and, indeed, the mythological representations of the negroes may often lead us back to a prototype which is also that of similar representations among the Aryan peoples.

The Timmi, for example, have a giant who resembles the Atlas of our mythology. He has to sustain the earth, which is disk-shaped. In the long course of the bearing of this burden the head of the giant and the earth have become one body; the grass which we tread upon and the trees that cover us with their shade are the hair of the giant; and the animals of every kind are the unwelcome guests of his hair. When the giant, tired of standing all the time in the same position, turns quickly, there is an earthquake. The traditions of the Timmi, like those of the Judæo-Christians, teach that evil and death came into the world in consequence of the sin of one man, while there was nothing terrible in the matter at first.

God permitted man to remain on the earth seven or eight hundred years. Then he sent one of his servants to warn him to prepare to go. The man took leave of his family, and serenely started on the journey to the other world. The legends which give the explanation of natural phenomena are, as may be imagined, extremely ingenious. Take, for instance, the Suahelian account of the ebb and flow of the tides: "An enormous fish, named Keva, lives under the sea; a great rock stands upon its back, and upon this an enormous ox with sixty thousand horns and forty thousand legs. His feet are planted on the rock, his nose rests upon the water, his hair sustains the earth. The animal breathes once a day, and as the volume of his body increases with his inspirations and diminishes with his expirations, so the level of the sea rises and falls."

African literature is very rich in fables of animals, which may be divided into the two categories of moral apologues and simple narrations. In the former such an identity is noticeable with stories of the peoples of Asia and Europe as almost to cause us to think that both proceed from a common source whence they were drawn in prehistoric times. To this may, however, be opposed the hypothesis of an original and simultaneous origin in different places; a question for the discussion of which we have not yet all the elements. One of the most brilliant of the African apologues comes from Somaliland, and is perhaps better than the corresponding European fable: "The lion, the hyena, and the fox went a-hunting, and caught a sheep. The lion said, 'Let us divide the prey.' The hyena said, 'I will take the hinder parts, the lion the fore parts, and the fox can have the feet and entrails.' Then the lion struck the hyena on the head so hard that one of his eyes fell out, then turned to the fox and said, 'Now you divide it.' 'The head, the intestines, and the feet are for the hyena and me; all the rest belongs to the lion.' 'Who taught you to judge in that way?' asked the lion. The fox answered, 'The hyena's eye."

In the second category of animal stories no hidden moral is proposed, but adventures are related corresponding to the character of the animals to which they are attributed. In Africa, as in Europe, the principal cycle is formed of what is called the Romance of the Fox; only there is no complete epic, but merely a number of isolated anecdotes, in which the hero is usually the fox, but sometimes the jackal, the hare, or the rabbit.

In the fables of the Hottentot tribe of the Nama, the jackal is directly glorified as a national hero, as the incarnation of the race of the Nama, and by his astuteness overcomes all his adversaries, first among which are the wolf and the "man of the white race." It is in place to observe here that when the primitive versions of the

fox romance began to be current in Europe, the fox, with his thievery, was odious to those peoples which, like the Germans, held brute force in high esteem. To call a man Reynard was regarded among the Franks as a grave offense, to which the Salic law attached a severe penalty. The negroes of Africa, on the other hand, set astuteness away above force. This idea dominates in all their literary production with which we are acquainted; and this confirms the assertions of travelers, who agree in saying that the Africans, when they try to get rid of their enemies, use force only when cunning fails. Herr Olpp cites the following fable of the tribe of the Nama: "It came to pass one day that the jackal, having made away with some object, fell into the hands of the white man. He was carefully bound and condemned to death. Then the jackal asked his judges, 'How do white men perform executions?' They answered, 'We beat the culprits to death with clubs.' The jackal replied: 'It is a very poor way of putting people to death; take my advice: when you want to put anybody to death, begin by making him eat tallow and fat; then grease him outside, and make a fire on a rock; take him by the tail and throw him into the fire.' The white men did as the jackal had told them, but their hands slipped on his skin, and he escaped. Thereupon the dogs chased him, and the fugitive had barely time to get into a cave. The white men, who had come up, stuck their hands into the hole, and one of them took the jackal by the tail and called out, 'We have got you, we have got you!' The jackal said, 'Oh no, my friends, you have not got me, but a root.' The white man holding on to the tail answered, 'No, it is you.' The jackal answered: 'I tell you it is not me. Get a sharp stone and then come back and cut what you have in your hand. You will see that it is a root.' The white man ran to get a stone, and the jackal went farther into the cave. So he saved his life."

This very succinct summary of the researches of the students of folklore of the African school may go to show that thought does not abound in the traditions of the negro tribes; the few flowers that are found here and there form only a very poor garland. —*Translated for the Popular Science Monthly from Minerva (Rome).*

DESCRIBING to the London Physical Society his observations on the Peak of Teneriffe, Prof. T. C. Porter gave an account of his method for measuring the diameter of the earth. It consists in observing the shadow cast by the peak upon the sea, and measuring the time that elapses between the moment when the apex of the shadow touches the sea horizon and the instant when it is eclipsed by the shadow of night. He observed, further, that the heated air ascending from the peak casts a shadow, seen as a faint prolongation of that of the peak.

SCIENTIFIC INSTRUCTION IN GIRLS' SCHOOLS.

By CAROLINE W. LATIMER,
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IT is impossible to turn one's attention in the direction of education to-day without being reminded that the present century has been characterized not only by a steady advance in our knowledge of the natural sciences, but by an ever-widening popularization of that knowledge. And one of the facts that strike us most forcibly in connection with this educational growth along scientific lines is that it has been coincident in time with the recent extension of educational rights and privileges for women. The physical sciences have therefore assumed prominence in women's education from the time that public attention was first focused upon them, and scientific instruction given to girls has been, from the time it was introduced into their education, in no way different from, or inferior to, that provided for their brothers.

The late Professor Huxley, in his speech on Scientific Education, delivered in 1869, described very forcibly the movement then arising toward a reform in school education from the side of natural knowledge—a movement which owed its existence in large part to his own persistent exertions. "The head masters," he says, "of our public schools—Eton, Harrow, Winchester—have addressed themselves to the problem of introducing instruction in physical science among the studies of those great educational bodies with much honesty of purpose and enlightenment of understanding, and I live in hope that, before long, important changes in this direction will be carried into effect in those strongholds of ancient prescription." Such was the provision, or lack of provision, for scientific training in the English public schools little more than a quarter of a century ago; and it is only necessary to glance at the prospectus issued by any one of the secondary schools for either sex, on both sides of the Atlantic, in the present year of grace, to find abundant evidence that, so far as "important changes" are concerned, Professor Huxley's very modest hope is now more than fulfilled. So radical a change in the old order could not, however, be effected without opposition; and this opposition found its most distinguished supporter in a man whose efforts toward the improvement of education were no less earnest than Professor Huxley's own. In 1871 Matthew Arnold wrote as follows: "If there is any other body of men which strikes one . . . as having before it a future still more brilliant than its present it is the friends of physical science. Now, their revolt against the tyranny of letters is notorious.

To deprive letters of the too great place they have hitherto held in men's estimation, and to substitute other studies for these, is the object of a *sort of crusade with a body of people important in itself, but still more important because of the gifted leaders who march at its head.*" The revolt here spoken of has certainly been accomplished and the changes inaugurated by it are fully in operation to-day. Thoughtful people, however, are now beginning to ask themselves whether these changes have really been followed by the beneficial results which Professor Huxley anticipated. And, if the introduction of scientific training into school education is not fulfilling the brilliant promise of its early years, what reason can be assigned for its failure to do so The Italics in the passage just quoted from Literature and Dogma are our own, and they have been inserted in order to call attention to words which are full of significance; for they suggest, though perhaps unconsciously to their author, an explanation of this very problem which confronts us to-day. The *principles* leading to the introduction of the physical sciences into school education proceeded, as was natural, from the "gifted leaders" of whom Matthew Arnold speaks. Our present difficulty has arisen from the fact that the *execution* of those principles has been carried out by the followers in the crusade, who are, almost invariably, as far from a right understanding of the cause which they support as was the unreasoning multitude led forth by Peter the Hermit. In their nineteenth-century ardor to see justice done to natural knowledge they have approached Dame Science cap in hand, crying: "This way, madam; every hill shall be made low, and every valley shall be exalted for your feet," until our present position is akin to that which Mr. Augustine Birrell tells we hold in regard to philosophy, and which he illustrates by an anecdote very applicable to our present purpose. There was once, he says, a native Westerner who paid a first visit to the Eastern States, and described his impressions of Boston to his friends upon his return. "It is a city," quoth this product of Western civilization, "in which Respectability stalks unchecked." According to Mr. Birrell, this is just what philosophical theories are doing among us to-day, but the idea is capable of extension. We can now be convicted on another indictment: that of having, so far at least as girls are concerned, permitted Science to stalk unchecked through our so-called secondary schools.

If we turn our attention to the details of scientific instruction in these schools to-day, we shall find it is almost characteristic of one which keeps abreast of the times that the natural sciences shall occupy a large place in its curriculum. The branches generally taught are physics, chemistry, physical geography, astronomy, botany, zoölogy, and physiology. I am not now concerned with the injury done to

natural knowledge by the existing custom of placing the instruction on these many and divergent subjects in the hands of one "general science teacher," for the subject has recently been ably treated in the Educational Review. There are two other considerations which are sufficient to occupy us at present: First, that if the time spent upon scientific training is to be divided among so many different branches, it is impossible that the real purpose of such training should be carried out. Second, that the attempt to take up all these subjects is actually detrimental to a scholar's mental growth; for it must be remembered that during the same space of time in which scientific instruction has made such rapid strides, the requirements in all other branches of knowledge have been in no way diminished; on the contrary, their tale of bricks has been in some respects increased.

There seems to be a general agreement that the importance at present attached to scientific knowledge is but the fitting recognition of its value as an educational agent. If we analyze the matter, however, we shall find that this agreement does not exist as to the exact nature of the value which is so universally admitted. There are, in fact, two distinctly different conceptions as to the use and purpose of scientific training, and it is very necessary to a right understanding of the questions we have just placed before ourselves for consideration that we should distinguish between these. One of the aforesaid theories is that of the physical scientists themselves, the "gifted leaders" who so earnestly advocated reform in their own line. Their views are best stated in the words of the man who led their advance guard, and whose just claim for the introduction of science into education we have already quoted. "The great peculiarity of scientific instruction, that in virtue of which it can not be replaced by any other discipline whatever, is this bringing of the mind directly into contact with fact, and practicing the intellect in the completest form of induction—that is to say, in drawing conclusions from particular facts made known by immediate observation. The other studies which enter into education do not discipline the mind in this way." This opinion, even though it is that of the highest authorities, is unfortunately held by a very small minority—in fact, only by the authorities themselves. The second theory as to the purpose of scientific instruction, to which the majority adhere, is that of the followers in the "crusade." These are the blind leaders of the blind; they are men and women whose actual knowledge of the natural sciences is almost *nil*, but they advocate the introduction of all of them into school training, because they consider that in a liberal education no educational stone should be left unturned.

Now, if the value of scientific knowledge lies, as Professor Hux-

ley tells us it does, in its usefulness as a means of educational discipline, then the methods by which it is learned must be such as to train the eye in observation, the hand in dexterity, and the mind in deduction and verification. Otherwise no educational discipline can be expected from it. It is obvious that these ends can only be attained by practical work; and for practical work two things are absolutely essential—time and apparatus. Four hours a week spent in practical work, together with one or two hours of more didactic instruction, is the least amount of time from which any real benefit can be derived. Furthermore, the practical work must be arranged for in periods of *two consecutive* hours, otherwise a large part of the benefit will be lost; and, if the seven branches of science now forming part of a girl's education are to be taught with any degree of thoroughness, this amount of time must be consumed in the case of each and all of them. It seems needless to say that such a state of things does not, and without injustice to the non-scientific side of education can not exist. We are come, then, to a deadlock. To carry out the principles laid down by scientists for scientific instruction in a number of branches requires an amount of time which no student can afford to give, and an amount of apparatus which few, if any, schools can afford to provide. Yet it is a matter of daily observation that, in some way or other, educational institutions have succeeded in including all the different scientific studies before mentioned in their graded courses of instruction. The explanation of this condition of things lies in the fact, already alluded to, that the executive side of scientific instruction has been left entirely in the hands of the people of liberal minds, whose fixed idea it is that no scholar should be allowed to reach the conclusion of her school career in ignorance of the broad outlines of *all* the natural sciences, for she knoweth not the day nor the hour when a superficial acquaintance with some one of them may be required of her. In the present system of instruction, which has been developed in accordance with this theory, girls acquire a knowledge of science in the same way that they acquire a knowledge of all the other studies in their school education—by studying a lesson in a text-book and reciting it to a teacher, who under favorable circumstances accompanies it with some limited amount of demonstration. Yet book work, as any competent judge in scientific matters will agree, is destructive to the vital principle which gives to natural knowledge its use and dignity. Nor is it any more likely to serve the purpose of non-scientific educators, for scientific information thus acquired makes no lasting impression on the mind, and can not exercise any broadening intellectual influence.

From what has been said we hope that the truth of our first proposition has been demonstrated—namely, that the present

methods of scientific instruction are urgently in need of reform. It remains to show that the practice of crowding so many different sciences into the brief period of school life is causing serious injury, not only to the sciences themselves but to education as a whole. This injury is especially due to the practice, which is part and parcel of the present system, of introducing scientific studies into the work of each one of the seven or eight years of school education. Nearly as much time is now devoted to science in the early years of school life as in the later, and before any real improvement can take place in scientific instruction the impression at present obtaining, that the earlier physical science is made a part of school education the better, must undergo some modification. This idea is based on the fact, which is a matter of common observation, that young children display great curiosity in regard to natural phenomena, and derive much pleasure from information in response to their questions concerning causes and results. But while this constitutes an excellent reason for encouraging the spontaneous activity of childish minds in the direction of Nature's laws, it hardly affords adequate ground for incorporating systematic scientific instruction into the routine work of their early years. It seems to be pretty generally agreed that the object of school education is to train the intellect to act readily as the servant of the will in that life-work whose honorable fulfillment is the aim of all education, and to store the mind with knowledge on the many subjects where ignorance would be prejudicial to success in that life-work. Now, the first of these objects is not likely to be furthered by allowing the studies most agreeable to a pupil to take precedence of others which require more effort, and therefore constitute a better mental training. There is a great deal of sound common sense in the old nursery rhyme which tells us:

"The twelve Miss Pelicoes, you plainly see, were taught
To do the things they did not like, which means the things they ought."

To be taught to do the things we do not like is a very important element in our education, especially in the education of our early years, for if that part of our training is neglected then, it can never be really made up to us, and we are at a disadvantage in adult life as regards the habit of self-restraint which constitutes the best basis for ultimate success. I do not apologize for obtruding what may appear a truism, for the neglect of the vital principle it contains is fast becoming a crying evil in the education of young children. As regards the second object of education, that of informing the mind, it can only be achieved by prolonged and vigorous exertion in the acquirement of many kinds of knowledge besides that of natural science; which knowledge, while it may be less interesting to a young

child than science, is really better suited by its nature to the mental activity of early years. The integral defect of the old-fashioned system of education (in which the Miss Pelicoes were so carefully trained) was its being based upon an excessive amount of pure memorizing; and from this error we have undergone in recent years a strong revulsion of feeling. Unfortunately, this has led, like all effective reactions, to the commission of faults in the other extreme, and we are now in danger of losing sight of the fact that the acquirement of knowledge *by memory* must, and ought to, constitute a large part of early education. So much has been said of late as to the duty of imparting to children a right understanding of natural laws, that we overlook the necessity of storing their minds with a knowledge of many subjects other than science. In the brief span of school life it is imperative to teach a fair amount of ancient and modern history; to cultivate the gift of tongues; to discipline the mental faculties in the precision of mathematical thought; and to instill a moderate acquaintance with the literature of English-speaking people, together with a reasonable facility of expression in the English language. Now if, in addition, it were possible to provide for a number of scientific studies the time necessary to derive from each one of them its special educational advantage, then indeed no effort would be too great to accomplish such an end. But it is not possible. Neither the mental nor the physical capacities of youth are equal to such a strain.

But, some one asks: Is not good scientific training of greater importance than other branches of education? Why should not a large amount of time be devoted to practical work in science from the beginning of school life, even if other subjects are set aside for the purpose? I answer, because the minds of young children are peculiarly apt at the kind of study in which the exercise of memory (I do not, of course, mean memorizing) plays an important part. In our recent and highly commendable efforts to reform the practice of learning largely by rote, we have undervalued the educational significance of the fact that children are able, by the *intelligent* exercise of their memories, to acquire information with ease, and to retain it securely, while those who have passed the point where the brook and river meet learn in this manner only with wearisome effort, and even then remember but imperfectly. Precisely the reverse obtains in scientific training. The qualities of mind which enable a student to reap the full benefit of observation and deduction grow with mental growth and strengthen with intellectual strength. If the non-scientific side of education is curtailed in the early years of school life, the pupils will be greatly the losers in all matters within the province of art and letters. If, on the contrary, their scientific training is postponed to a late period, they will find it a gain

rather than a loss. There is abundant evidence in support of this statement in our colleges for women. In them experience has shown that not a few of the students who have displayed marked aptitude for scientific work in their collegiate education, and some of those who have successfully carried on individual research, have had very little instruction in science before entering college. On the other hand, students whose choice in collegiate work is non-scientific, whether their choice be mathematics, classics, or modern languages, find that, unless their early training has been prolonged and thorough, the difficulties in the way of their ultimate success are almost insuperable.

If it is agreed, then, that scientific instruction under the present methods already consumes time which should be devoted to letters, it is evident that reform in these methods can not be instituted at the expense of the non-scientific side of education. There is, therefore, but one road to a better state of things. The existing system must be reorganized in such a manner that the whole, or at least a large part, of the time that justice allots to natural knowledge shall be spent on not more than two branches of science. This is really the only way in which a student can derive any training of the eye, the hand, or the deductive faculties, and, as the benefit which a student derives from such training is largely dependent on her being of an age to profit by it, the instruction must be given during the last two years of her school life. Five to six hours a week is, as was said before, the minimum amount of time from which good results can be obtained; and if this time were divided into not more than three periods, it would be possible to arrange something of the nature of laboratory work. Under such a system it is almost impossible that a pupil should not make real progress toward the end in view—that is to say, her mind would be brought into direct relation with Nature at the period of her school life when she is most responsive to the stimulus of such contact.

Already I feel my elbow jogged by the men of liberal minds, who urge that such a method as that just described would permit students to enter into life halt and blind as regards those of the physical sciences which were not selected for instruction. There is an element of truth in their argument that no girl ought to be in such complete ignorance of any natural science that she is unable to comprehend an incidental allusion to it. But this theory of the purpose of scientific knowledge can be carried out with a very small expenditure of time. The facts which the student needs to grasp are not many, and they ought to be encumbered with as little detail as possible. If, during the two school years immediately preceding those in which systematic instruction in science is to be given, one or two simple lectures were delivered each week on the outlines of

such of the natural sciences as were not to be studied later on, the object of non-scientific educators would be fully attained. Such lectures ought to be quite unaccompanied by book work. The native curiosity of childhood in regard to natural phenomena can be fully depended on to secure attention at the time, and remembrance afterward. It must be added, however, that an interesting lecturer is essential.

If only two branches of natural science are to be introduced in detail into school education the question of selection becomes of importance. The biological sciences are undoubtedly those which bring the mind into the widest and deepest relations with Nature; and this would seem to constitute a sufficient reason for preferring them. I am aware, however, that in giving precedence to these sciences I put myself in opposition to the idea, now much in favor with the colleges, that physics and chemistry are more suitable for school instruction; but I do so because we are now concerned with the education of girls, not of boys. Everything that has been said so far applies indifferently to the training of either sex, but we have now reached the point where the little brook arises which by and by forms the mighty stream that separates and must always separate the life-work of women from that of men. The practical uses of an acquaintance with physics and chemistry are so great in many of the trades and professions by which men earn a livelihood that even an elementary knowledge of these subjects will often give its possessor an advantage in the race. There is also reason in the statement of the colleges that physics and chemistry form the best basis for future scientific work within their precincts. But these trades and professions are not, as a general thing, adopted by women; and so far as collegiate work is concerned it must be remembered that the number of girls who go to college is but small, and of these the proportion who devote themselves to scientific work is still smaller. It is not our present business to discuss the question whether a college education for women is ever likely to become general. The case as it stands now is that, for the large majority of girls, the science they learn in their school years represents for them all the science they ever acquire. Hence it should be of the kind that is most likely to minister to their necessities. If the biological sciences then are most suitable for their instruction, one of the branches chosen should be either botany or zoölogy; the other always and invariably physiology, because, I repeat, we are now discussing the education, not of boys, but of girls. The recognition of any difference between the education of the two sexes is, I know, not a popular idea. But there is surely some inconsistency in the fact that the friends of women's education who have done so much to establish a high ideal of life for women should receive with such disfavor any hint that, whatever

changes may occur in outward conditions, girls will always be, as they always have been, potential wives and mothers. The fact, however, remains that the charge of young and helpless humanity belongs by nature to women, and that much, if not all, of the well-being and happiness of children, both present and future, depends on their physical necessities being rightly understood. To a woman who lives her life under the domestic conditions which it is now unfortunately the thing to consider narrow, it is of little consequence whether she understands the principle of a Torricellian vacuum or the significance of the periodic law, but it means much both to her and to others that she should have a correct knowledge of the natural laws that govern physical well-being. This remark is of an old fashion, but the truth it contains is eternally new, and therefore it is not only strange, but sad, that the grace of the fashion of it should be in danger of perishing.

Scientific instruction, then, in girls' schools to-day is not carrying out the honorable intention with which it was introduced into education. The "crusade" spoken of by Matthew Arnold is indeed responsible for much of the harm he ascribes to it. But, just as Wilkes claimed that he had never been a Wilkesite, so the "gifted leaders" would probably be little in sympathy with much that is done in their name. It is only by conforming to their original conception of the purpose of scientific instruction that we can succeed in avoiding the rock of complete neglect of natural science, and at the same time escape falling into the whirlpool of injury to art and letters. From the former of these perils we have indeed been recently delivered, but the force of our recoil has been such that there seems at present some danger of our being swept into the latter.

One point remains upon which to comment in conclusion: it is essential to the success of any reform in scientific instruction that the movement toward it shall proceed from the general public as well as from the school authorities. I hope, and from certain signs of the times I believe, that an impulse in this direction is now stirring in the minds of both educators and parents. That the time is now ripe is indeed my excuse for the existence of this article, which it is hoped may offer some suggestions as to the cause of an educational difficulty that seems to be felt at present even more by parents than it is by educators. But it is of course only one of the many such difficulties that beset the close of the nineteenth century. Indeed, the whole question of girls' education has now become so complex that a conscientious father to-day must often be ready to echo the words of the old song in the Beggar's Opera:

"I wonder any man alive
Should ever rear a daughter!"

THE ROMAN HIGHWAYS.

By D. R. McANALLY.

THE Romans were noted for many things, but for nothing do they better deserve fame than for the system of roads which connected every part, even the remotest province of the empire, with Italy and the capital. During the golden days every road literally led to Rome, for outside the limits of the Roman world there were no roads worthy of the name, and within its limits every highway was but a part of the system which had its center in theAppian Forum.

The system was worthy of the conquerors of the world. Starting from the Forum, the great Appian Way, the first which was built, passed through the Porta Capena and swept off to the south, through the Three Taverns, where Paul met the Christian Church, through Terracina, through Capua to Brundisium, where sailing craft and rowboats were always ready day and night to take the traveler over to Dyrrachium. Landing on the Macedonian coast near the modern city of Valona, the traveler might traverse a good Roman highway in an almost direct line seven hundred miles to Byzantium. In Asia the great highway again began, trended off to the south, followed the coast to Troy, sent off branches to numerous and populous cities of Asia Minor, across the mountains to Ancyra, followed the coast to Tarsus, thence to Antioch, to Tyre, and to Jerusalem. It is probable there was also a highway from Jerusalem to Alexandria in Egypt. There were certainly roads from Jerusalem east to the Euphrates, and up and down that mighty stream. Egypt had its own system of roads, beginning at Alexandria and continuing south to the Cataracts, while North Africa was also provided with internal arteries of commerce, starting from various seaports and penetrating the interior until lost in the sands of Sahara.

The Appian Way was the great highroad to the south of Italy and to the East, but the empire was provided with a northern system also. The northeast road started from Rome, crossed the Apennines on the upper waters of the Tiber, and continued through many important cities to the base of the Alps. South of Trent the road divided: one branch turned east, passed through what are now the territories of Austria, Bosnia, Servia, and Bulgaria to the Black sea; the other continued to the north and traversed the terrible passes of the Tyrol to the lower lands of South Germany. There was yet another great central highway which started like the others from Rome, went directly north, continuing, however, east of the Apennines, and following the east coast passed through or near the pres-

ent cities of Genoa, Nice, and Marseilles. There it divided: one branch turned north directly through France, passing by many important cities till it reached a point near Boulogne, where, as at Brundisium, boats were always in readiness to carry passengers to Britain; the other branch, starting from Marseilles, traversed the Spanish Peninsula to its remotest part. England had its own roads; beginning near Dover, a leading artery ran to the north almost straight to York, while the others traversed the island from east to west.

The length of the Roman system of roads from the Wall of Antoninus in Britain to Jerusalem was four thousand and eighty miles, and, to the extreme limits of the empire on the Euphrates, about four thousand five hundred miles. From city to city the Roman roads usually went in a straight line, property being condemned and appropriated for the public use without the slightest regard for the feelings or rights of its owners, while natural obstacles were almost ignored. Mountains were tunneled, morasses filled with stones and earth; up one side of a hill and down the other went the road, for, as travel was altogether on foot or on horseback, and wheeled vehicles were not used in the country, a steep grade was no objection. Bold arches of heavy, solid stones were thrown across the smaller streams, while great bridges spanned the rivers. Trajan's bridge over the Danube had twenty-one piers of stone built on piling; each end was fortified by a camp and outworks, and when the structure was destroyed its ruins blocked the river. Many Roman arches over mountain gorges and smaller streams are still in existence. In Wales, the Devil's Bridge near Aberystwyth bears testimony to the solid and lasting character of the work done by Roman engineers; in Spain and Portugal many Roman arches remain to show that honest building could be done in the days of the Cæsars. Here and there in the Alps, in the Pyrenees, in the Tyrol, in the Balkans, the remains of a Roman road lead up to the side of a mountain where a half-closed or entirely blocked tunnel once pierced the giant mass. Here and there in the lowlands of the Danube, in the plains of the Po, on the lower waters of Belgium, the trace of a highway leads into the depths of now impassable quagmires, which, however, were no obstacles to the indefatigable road builders.

They did their work well. When a route had been surveyed and a line of road from eight to twenty feet wide was staked out, the surface of the earth within the inclosed limits was all removed until the clay bed was reached. This was densely packed with rammers: a layer of small stones was placed in position and rammed into the clay with heavy mallets, then another layer of stones and sand with cement; then a layer of sand or gravel with lime mortar; then layer after layer of broken stones cemented into one mass, and above all

these layers, aggregating more than two feet in thickness, were placed bowlders of basalt or granite, from the size of a man's head to that of a half barrel. The sides were roughly trimmed to make the joints even; the tops were hammered to present a smooth surface to the foot of the traveler, and the whole was cemented together with such skill that after two thousand years of wear many of these roads may still be used. Near the cities more pains were taken; the granite blocks were hexagonal, carefully trimmed and evenly jointed. On the Appian Way the pieces were so neatly fitted together that even to-day it is difficult to detect a joint. The center of the road was the highest; on each side were gutters to carry off the water; if the road ran through a flat country, the gutter became a ditch; if through a country where the fidelity of the inhabitants was doubted, a breast-high wall on either side of the road made it an almost unassailable fortification. In country districts no house might stand within two hundred feet of any road, nor were any trees or bushes allowed to grow in the same limits, for the Roman highway must be safe, and robbers and evildoers must have no place of concealment in its immediate vicinity.

The country roads had at every half mile a block of stone placed by the wayside for the convenience of the traveler in remounting. On the Appian Way, for a distance of twenty miles from Rome, stone seats were placed for travelers at every forty feet; wherever a spring sprang from the earth near a road, a well was hollowed out and a cup provided at the well, and chained to a large stone, in order that travelers might quench their thirst and leave the cup for the next comer.

The roads were military in their character, the prime object being to facilitate the march of the legions. No country was considered conquered until roads had been constructed in every part, and an evidence of their value may be found in the fact that the first step taken by rebels in every local insurrection against the Roman power was to tear up the roads and destroy the bridges. These efforts were generally unsuccessful, for only gunpowder can prevail over such layers of stones and cement as constituted a Roman road, and the barbarians had no powder. In times of peace, the legionaries were employed in road building to keep the men out of mischief, but soldiers were not the only road workers. Criminals and slaves were set to work to make and mend the highways, and, where none of these were available, persons were hired to repair and construct the roads. Every governor of a Roman province had the strictest orders to see to the roads, and when a new line was projected through provincial territory it sometimes happened that the whole male population was summoned to assist in the undertaking.

Captives were frequently employed on the road. After the destruction of Jerusalem by Titus, the spectacle of Jewish chain gangs at work on the highways was a common sight all over the empire, and the spectacle again became familiar to Roman travelers sixty-five years later, after the unsuccessful rebellion of Bar-Chochebas, when the Romans, after almost incredible butcheries, determined to depopulate Judea as the best way of solving the question in that province.

Although the prime object of the roads was military, the emperors availed themselves of these admirable highways to obtain quick intelligence from all parts of their extensive dominions. All roads were divided by mile posts, and at every fifth mile on the Roman highway stood a posthouse. Forty horses were always in readiness at each station, and with rapid changes it was possible for an imperial messenger to travel one hundred miles a day, or even more. During the reign of Theodosius a messenger bearing news of a dangerous revolt rode post from Antioch to Constantinople, leaving the former city at night and arriving at Constantinople on the sixth day at noon, thus traveling seven hundred and twenty-five Roman or six hundred and sixty-five of our miles in five days and a half. Sometimes the use of the emperor's posts was granted to ministers, and to favorites whom the emperors delighted to honor. It was, however, a rare favor. Pliny sent his wife on post horse from Rome to the country, and, although a minister, came near having trouble with the emperor in consequence of doing so, for the post horses were as a rule employed only on government business. It was one of these posts that brought Augustus the news of the loss of Varus and his legions; it was a post that brought Nero the tidings of Galba's insurrection.

Crude as we should deem them, the Roman roads were strongly built, safe, and permanent, and even their ruins are among the greatest remaining wonders of that remarkable people.

PROF. W. MCK. CATTELL, writing of anthropology at Columbia University, finds it natural that that branch of research should be relatively late in coming to the front, because science must first cover the fields where the material is most stable and most accessible to experiment. "Thus, during the first half of the present century the most important advances were made by the physical sciences; then biology made the greatest progress; now, at the end of the century, it seems likely that the sciences concerned with man will become leading." This science has not been fostered by the universities, but has developed till it has compelled recognition. It is cultivated in the German universities, is recognized by a considerable school in Paris, and in chairs of criminal anthropology in Italy, and courses in it have been established in the Universities of Chicago and Pennsylvania and at Columbia.

SKETCH OF ANDREW CROMBIE RAMSAY.

SIR ARCHIBALD GEIKIE, from whose Memoir the material for our sketch is derived, speaks of Sir Andrew Ramsay as having stood in the forefront of the geology of his time, and as having "by the charm of his genial nature, as well as by the enthusiasm of his devotion to science, exercised a wide influence among his contemporaries." Having joined the British Geological Survey when it was still in its infancy, and having remained on its staff during the whole of his active scientific career—"so entirely did he identify himself with the aims and work of the survey, and so largely was he instrumental in their development, that the chronicle of his life is in great measure the record also of the progress of that branch of the public service."

ANDREW CROMBIE RAMSAY was born in Glasgow, Scotland, January 31, 1814, and died at Beaumaris, island of Anglesey, Wales, December 9, 1891. His father, William Ramsay, was a manufacturer of commercial chemicals, and invented processes that might have made his fortune if patented, but gave them to the world. He was a child of remarkable determination. Being in delicate health, he was sent to the parish school in the seacoast village of Salcoats, where in the natural and physical features and scenery of the region there was much that might have contributed to rouse the observing faculties. In time he was enrolled in the grammar school at Glasgow. After the death of his father, in 1827, he was placed in a counting-house, with the expectation that he would follow a mercantile career, and afterward in the warehouse of a firm of linen merchants, where he seems to have been unhappy. He had acquired a taste for literary pursuits, was "an omnivorous reader," and from the very outset "kept his interests broad." One of the developments of this side of his life was seen in the production of a manuscript periodical, Ramsay's Miscellaneous Journal, by himself and a few other young men, of which he was the editor during 1835 and 1836. About 1837 he formed a partnership with a Mr. Anderson as dealers in cloth and calico, the failure of which after three years left him poorer and disgusted with an occupation that had never had any great attraction for him.

His attention was gradually drawn to geology by the remarkable features presented in the island of Arran, where he was accustomed to spend his summer vacations. Having become acquainted with some of the professors and students of the University of Glasgow, he used to meet Prof. J. P. Nichol there, and enjoy long walks with him, and was introduced to Lyell by Lyon Playfair, who as a student

in Glasgow boarded in his mother's house, and accompanied the "father of modern geology" in some of his excursions. In the successive tours and excursions he took he went over ground which had been partly explored by the earlier geologists and of the structure of which they had published accounts that could not, however, "be regarded as more than outlines of a whole subject, which would require years of patient research before its details could be mastered." He had not intended to criticise their work or to publish his observations, which he made for his own gratification, but "gradually he found that various facts met with by him in the course of his rambles had not been noticed by others before him." He spoke of them to Professor Nichol, who, looking forward to the meeting of the British Association in Glasgow in 1840, was preparing a geological model of the island of Arran. He made Ramsay secretary of the local subcommittee of which he was convener, and in reporting the success of his work gave his young friend the whole credit for it. Before this meeting Ramsay read his first scientific paper, which was a description of the work he had been drawn into, at the session held on the eve of an excursion which the geologists of the association took to Arran. Toward the end of this year he published a small book, with a map and illustrations—The Geology of the Island of Arran from Original Survey—which "has long since taken its place among the classics of Scottish geology."

Murchison, having met Ramsay at the British Association, had formed a high opinion of his geological capacity, and now, while the young man was preparing his book for the printer, invited him to accompany him on a geological excursion to Russia. The invitation was a welcome surprise to Ramsay, and he proceeded at once to take advantage of it. When he reached London, in March, 1841, he was informed that Murchison had given up taking him to Russia, but had procured him a place as assistant geologist to De la Beche, who was making the Ordnance Geological Survey for the Government. He was appointed on a salary of nine shillings a day, excluding Sundays, and, proceeding to his post, arrived at Tenby, Wales, April 2d, "there to begin a career in the Geological Survey which was to last until he had risen to be the head of the service, and one of the foremost geologists of his day." The field work of the survey had been a year or two in progress in South Wales when Ramsay joined it, and there were then four assistants on the staff besides him; with, in addition, Prof. John Phillips as paleontologist.

The geological structure of the region in which he labored proved to be excessively complicated. "It had been only cursorily examined by previous observers," and "its real difficulties remained to be discovered and grappled with." Two years later Murchison spoke to

the Geological Society of the results that had been obtained among strata so obscured by change, as "among the very highest triumphs of geological field work," and mentioned Mr. Ramsay as particularly cited by the director among the laborers who had obtained them. When in 1845 the survey was transferred to another department, and enlarged by the inclusion of Ireland, Mr. Ramsay was made local director for Great Britain, with a salary of £300. He was to have immediate supervision of the field work of the staff, to see that the mapping was all conducted on uniform methods, to confer with the officers on their difficulties, to bring the experience gained in one district to bear upon the elucidation of another, so as to insure harmony and steady progress in the field work, and the supervision of certain matters of indoor work. To a book of memoirs prepared by the members of the survey at this time, Ramsay contributed a paper on the Denudation of South Wales and the Adjacent Counties of England, which is characterized by his biographer as having been the first attempt to reduce the phenomena of denudation to actual measurement by constructing horizontal sections on a true scale, and showing what thickness of rock had actually been stripped off the face of the country. Some expressions in it led to a correspondence with Darwin and Lyell respecting the relative force of disturbance in geological and recent times. In March, 1847, he delivered his first lecture before the Royal Institution, on The Causes and Amount of Geological Denudations. In June of the same year he accepted the professorship of geology in University College, London, on terms by which it was arranged that his duties there should not conflict with those on the Geological Survey.

Two papers read before the Geological Society in April, 1848, one of which was by Professor Ramsay and W. T. Aveling, are interesting in the history of British geology, inasmuch as they gave the first published outline of the results up to that time obtained by the Geological Survey in North Wales. Although they were mere sketches and printed only in abstract, the director general, Sir Henry de la Beche, was apprehensive as to the consequences of their appearance before they came out through an official channel. He held that the results described were obtained by public servants at the cost of the state, and were the property of the country, and not of the individuals who made them. Some of the staff chafed under the restraint, and it was Professor Ramsay's privilege to effect an arrangement with the director general under which papers might be read at the society after having been submitted to and approved by him. Professor Ramsay thought this was a great point gained, for the survey was "not half enough before the public."

Professor Ramsay had held a very poor opinion of the glacial

theory, and for many years during his surveys paid no attention to it. His first recorded mention of it was a diary entry in March, 1845, recording a "jolly night at the Geological; Buckland's glaciers smashed"—the reference being to a paper read by A. F. Mackintosh on the supposed evidences of the former existence of glaciers in North Wales, controverting conclusions previously published by Buckland.

It was during the survey of the Snowdon region, where "he achieved his chief geological triumph" in unfolding the complicated history of former volcanic activity contained therein, that he began to regard the subject of glacial action seriously, and this not till he had been at work there several months. His first reference to the subject occurs in the record of a visit by Robert Chambers to him at Llanberis, in August, 1848, when Chambers and he are mentioned as having gone "out on a glacial excursion up the Pass." A walk across the hills the next day revealed "splendid examples of glacial action." The search for such examples was the special object of Chambers's visit. By the 15th of November, however, he seems to have recognized everywhere the peculiar smoothing and polishing produced by moving ice, and he described the summit of a certain precipice as being, "as usual, well grooved with glacial undulations." His first public profession of belief in the former existence of glaciers in Wales was on the occasion of an address to the Geological Society in December, 1849, on the Geological Phenomena that have produced or modified the Scenery of North Wales, in which glacial action was presented prominently. The lecturer at the same time gave new and original proofs of the former presence of glaciers, "particularly instancing cases where mountain lakes were still held back by ridges of terminal moraine, and where large blocks of rock were perched on ice-worn crags." After this his notebooks contain frequent references to glaciers. Thus he went on, meeting frequent new illustrations of the history of the Glacial period, with his eyes now opened to the existence and significance of the facts whereby he was "led to perceive the meaning of many scattered surface features in South Wales to which, at the time he was surveying in that region, he had paid little heed." On the 26th of March, 1851, he communicated his first paper on glacial phenomena to the Geological Society, On the Sequence of Events during the Pleistocene Period as evinced by the Superficial Accumulations and Surface-markings of North Wales. Having withheld this paper from publication a year for more mature study, he issued it in 1852 under the title of On the Superficial Accumulations and Surface-markings of North Wales." The chief point insisted upon in it was the prevalence of two glaciations—one widespread and prior to the deposition of the drift, the other local in the valleys and posterior to it.

After their marriage, Professor Ramsay and his bride, Miss Louisa Williams, a Welsh lady, took a wedding tour through Switzerland, and Professor Ramsay got his first view of a real glacier "far away toward the summit of the Uri Roth Stock," while crossing the Lake of the Four Cantons, and observed the enormous contortions of the rocks of the region. He made also a special excursion to the Upper Aar Glacier. These experiences "quickened his desire to renew the study of the Welsh phenomena, and sent him back with a far more vivid conception of what the conditions must have been in the Ice age among the hills and valleys of this country." He "threw himself more and more into the study of the superficial contours of the land, and among the various agents by which these contours had ben molded and modified he specially devoted himself to the investigation of the work of ice"; and among those who led the way to a more comprehensive investigation of these phenomena, "and who made the Glacial period one of the most absorbingly interesting of all the geological ages, a foremost place must always be assigned to Sir Andrew Ramsay."

The Government School of Mines, and of Science applied to the Arts, having been established on the removal of the Geological Museum to new quarters in 1851, Professor Ramsay was appointed lecturer on geology and its practical applications. This compelled his resignation of the professorship in University College. Besides the course of thirty lectures given twice a week, he delivered his courses in the system of evening lectures to artisans in which all the teachers engaged, giving six lectures each in the season, and which have been up to the present time eminently popular among the class for which they are designed. Professor Ramsay's first course, on the Utility of Geological Maps, was so acceptable that its repetition was called for. Among the results of the impulse given to the recognition of the importance of science in national progress that followed the Great Exhibition of 1851, was the establishment of the Department of Science and Art, under the control of the Board of Trade and afterward of the Privy Council, to which the Geological Survey, the Museum of Practical Geology, and the School of Mines were transferred. It was also decided to extend the Geological Survey to Scotland, and Professor Ramsay was sent there in 1853 to arrange for its operations, which were begun under his immediate direction in the smmer of 1854. The onerous duty, which nobody was so competent as he to perform, of preparing, from his surveys, a connected description of the geology of North Wales, was undertaken, and became his chief indoor labor for twelve years. The chief of the survey, Sir Henry de la Beche, died in April, 1855. Professor Ramsay had been led by Sir Henry to suppose

that he would be designated as his successor, but it was found that vigorous efforts were making to put in the office a man who had only a very slender acquaintance with geology. To avert this disaster, Professor Ramsay suggested to his associates that they unite in recommending Sir Roderick Murchison. The recommendation was heeded, and Murchison was appointed.

In the summer of 1857 Professor Ramsay came to America to attend the meeting of the American Association for the Advancement of Science at Montreal. He was warmly received by our leading geologists, and visited the Great Lakes, examined the more remarkable geological features of the State of New York, and was entertained at New Haven and Boston. "The chief geological features of this expedition," Sir Archibald Geikie says, "were given partly in a discourse to the Royal Institution, but more fully in a paper read before the Geological Society. Ramsay had not yet realized the massiveness of the land ice of the Glacial period. Like most of the geologists of the day, he still regarded the 'drift' as the result of transport by icebergs, and to the same agency he attributed the striæ on the sides and summits of the hills. He recognized the remarkably ice-worn character of Canadian topography, but he did not yet associate that character with a former extensive glaciation by land ice. Nevertheless, he now beheld the effects of this glaciation in a far grander scale than he had ever before seen them, and unconsciously he was accumulating material that would enable him to get rid of the paralyzing idea that the land must have been submerged beneath the ocean as far as the highest striations or drift deposits could be traced. He was not, however, able entirely to divest himself of the old error until the summer of 1861." Four summer vacations after this were spent, till 1862, in excursions to the Alps and to points of geological interest in Germany, where "Ramsay could hardly find himself face to face with new scenes without being led to notice and reflect on the features in them which bore on any of the questions in geology and physical geography which had always been with him such favorite subjects." During these tours he was revolving a problem that had never been seriously attacked, and of which no tenable solution had yet been proposed—that of the origin of lake basins. His attention had been directed to the subject in America, although he formed no new opinions here. But the recognition to which he had now (1861) come, that the older and greater glaciation here was the work of stupendous sheets of land ice, "gave a new turn to his thoughts regarding the terrestrial contours of glaciated regions," and he came to the conclusion that "in a vast number of cases, where the lakes lie in rock basins, these basins have actually been scooped out by the grinding power of land ice." He

communicated his paper embodying these opinions at the meeting of the Geological Society, in 1862, succeeding that in which he had been elected its president. His views met with strong dissent from the older geologists, while "most of the younger bloods," as he called them, accepted them.

The imperfection of the geological record, to which Darwin had called attention, became more forcibly impressed on his mind. He was struck by the extraordinary gaps in the succession of organic remains, even when there was no marked physical interruption of the continuity of sedimentation, and connected them with geographical changes of which no other trace had survived. He had spoken on the subject at the meeting of the American Association, and now made "Breaks in the Succession of the British Strata" the subject of his presidential addresses in 1863 and 1864.

Another change in the organization of the Geological Survey was made in 1867, when Scotland was constituted a distinct branch, and Professor Ramsay's title became Senior Director for England and Wales. Sir Roderick Murchison died in October, 1871, and after a few months' delay for the consideration of various other questions, Professor Ramsay was appointed Director General of the Geological Survey, being, "after thirty-one years of service, placed officially at the head of the organization of which he had so long been the life and soul." The reward came to him, however, "too late to enable him to profit by it as he would have done had it been conferred ten or fifteen years sooner." One of his excursions abroad resulted in a paper on the Physical History of the Valley of the Rhine, and a discourse to the Royal Institution on the same subject. He resigned his lectureship, "which in these last years of failing power had become an increasing burden," in June, 1876. He was made president of the Swansea meeting of the British Association, in 1880, and presented an address embodying a general summary of all the geological branches in which he had worked. At the jubilee meeting the next year, in York, as the oldest surviving president of Section G, he was made its president again, and delivered the address, principally dealing with the progress of geology for the past fifty years, with much difficulty. Later in the fall he was knighted, and on the last day of 1881 he retired from the public service.

During the last ten years of his official life Sir Andrew Ramsay gave much attention to the physical history of river valleys, concerning which he sought to trace the cause of the flow of the rivers of a district in the ancient topography of the region, and published special papers on the valleys of the Rhine and the Dee. He was a thorough uniformitarian in geology.

It is not by the visible amount of published work—Sir Archibald

Geikie gives a list of eighty-one books and papers published by him, forty-six maps, and twenty sectional drawings embodying results of his surveys—that we can rightly estimate the extent of Sir Andrew Ramsay's influence in promoting the advance of geology. For nearly thirty years he was a teacher of geology, and "year by year," Sir Archibald Geikie says, "a fresh band of young men came to listen to him, and to carry the fruits of his instruction to all parts of the world. Season after season he lectured to workingmen, who flocked in hundreds to hear him. His lectures were not written out, but delivered from notes, and were always kept up to the latest conditions of the science." Much of his work was published only in this way, or in informal remarks to the Geological Society, when in the excitement of discussion "he would pour out from his full stores of information, and, taking his audience into his confidence, would flash out new views that he had never communicated to any one before." Another form of instruction, less palpable, but equally valuable, was the practical training he gave the men of his staff in the Geological Survey. "Never was there a more delightful field instructor than he. Full of enthusiasm for the work, quick of eye to detect fragments of evidence, . . . he carried the beginner on with him, and imbued him with some share of his own ardent and buoyant nature. . . . He would take infinite pains to make any method of procedure clear, and was long-suffering and tender where he saw that the difficulties of the learner arose from no want of earnest effort to comprehend. . . . If a man had any geological faculty in him, it was impossible that it should not be stimulated and educated under such a teacher." He had a singular gift of conversation, "which enabled him to draw out of a man who had any special knowledge to impart such information as served to elucidate geological questions."

Professor Ramsay records in his diary that in 1843 he refused the Geological Survey of India; in 1859 he began to write popular geological articles for the Saturday Review, which he continued to contribute for several years; in 1862 he received from the King of Italy the order of Saints Maurice and Lazarus in recognition of his scientific attainments and of his services to Italian officers sent at various times to England on missions of scientific inquiry; in 1866 he received the Neill prize from the Royal Society of Edinburgh; in 1871 he received the Wollaston medal from the Geological Society; in 1879 he was elected a corresponding member of the Royal Academy of the Lincei, Italy; in 1880 he was awarded a royal medal by the Royal Society "for his long-continued and successful labors in geology and physical geography;" and he received the degree of LL. D. from the University of Edinburgh.

Editor's Table.

COMPETITION AND THE GOLDEN RULE.

THERE are some advocates of socialism who sum up their arguments against the existing social *régime* by affirming that competition is the direct negation of that rule of conduct which enjoins upon us to do unto others as we would that they should do unto us. The issue is a simple one and deserves a brief discussion.

Let us first consider the meaning and scope of the principle of action to which appeal is made. It is apparent, at the first glance, that it is meant to prohibit and exclude acts of wrongdoing and aggression which, if applied to ourselves, we should feel disposed to resent and if possible to resist. Of a large class of such acts the law takes cognizance, making itself the protector and avenger of those who have suffered injury. But if we take a number of typical cases of competition we shall see that they involve no aggression whatever and justify no resentment. Nearly all sports, to begin with, are competitive; but the winning of a game, provided it is done by fair means, is no violation of the golden rule. True, the loser wanted to win, but he did not want his opponent to *let* him win. All that can be demanded or desired of opponents in such a case is that they shall play honorably and according to the rules of the game. If the conquered party cherishes any rancorous feelings against the conqueror for having beaten him in fair play, that simply puts him wrong with the golden rule, because he would not have wished such feelings to be cherished against him had he been successful.

From play we pass to the business of life. Two firms tender for a contract; two architects submit plans for a building; two teachers apply for a situation; two politicians contest the same constituency; two dealers carry on business in the same neighborhood. The successful firm, the successful architect, the successful applicant, the successful candidate, the more successful of the two dealers—none of these have done any wrong by the mere fact of his success, nor can he be said to have gone counter to any demand made upon him openly or tacitly by his competitors, *unless* he has gained his point by underhand or otherwise unfair means. Explore the breast of each competitor and what wish do you find formulated there? A wish to succeed. That of course, but what wish as regards the action of other men? Is it a wish that the contract, situation, etc., should be given to him on his own terms, without competition or without consideration of the wishes or interests of others? Such a wish would itself be too obvious a violation of the golden rule to call for discussion; so we are still compelled to ask, What is that wish in the mind of a given individual which could impose itself as a rule of action on others? The more we think of it the more clearly and irresistibly it appears that the only demand any one can make possessing the least character of moral authority is a demand for justice, for fair dealing. In the cases above supposed every demand which an individual could avow would be met by fair dealing on the part of his competitors and of those upon whom the award depended.

But there should not be any competition at all, the socialist will reply; competition is itself immoral. Again, let us get close to the facts. Competition, if we consider it as a word, is an abstract noun—so the grammarians used to tell us—and abstract nouns can not be accused of immorality. If we consider it as a thing, then it is a form of human action, and we must throw the immorality back on the men who practice it. Now, in what individual action does the immorality begin? Let us, if possible, get at the *fons et origo mali*. A certain household requires a domestic servant. Is it wrong to decide between the applicants according to their merits? Is it wrong to reject an inefficient person in favor of an efficient? A man wants a tutor for his boys. Is it wrong to insist on proofs of scholarship and character? A merchant wants a bookkeeper. May he be allowed to prefer one who comes to him with good recommendations to one who has none, and whose appearance and manner are not in his favor? If such things as these are permissible, we have the outlines of competition clearly traced; yet is there anything immoral in assigning a task, with its accompanying reward, to the person best qualified to perform it? But the world, it will perhaps be contended, should not be arranged in such a way as to allow two persons to want the same thing. Possibly, if some of our socialist friends could "grasp this sorry scheme of things entire," they might do some notable "remolding"; but whether they would really advance human happiness is quite an open question. Zola somewhere says that if they had their way they would make the very dogs howl with despair; but, however that may be, it is evidently difficult to fix the responsibility for competition on any power less general than that which made the world.

The golden rule (to get back to it) bids us do to others as we would be done by. The rule is laid down for all alike, and, strictly speaking, no one is entitled to claim the benefit of it who is disregarding it in his own practice. The man who shuns honest industry is not doing as he would be done by; he wishes *others* to work that *he* may eat. Yet, if we mistake not, the golden rule is often invoked on behalf of those who are systematic violators of it, whose whole lives are an injury to society. No moral rule could ever have been intended to place us at the mercy of one another's *desires*, and in the case of this particular precept we are required to seek within ourselves, and not simply in the desires of others, the law we are to follow. It is what *we* would that men should do to us that we are to do to them. The responsibility is thus thrown upon us of determining the demands which, in given circumstances, we would make —i. e., ought to make—of other men. Which of us, then, would say, "We demand that, whenever we want a thing, we shall get it, no matter what claims others may have, or think they have, to the same thing"; or, "We demand that whatever we ask for we shall get, independently of merit or qualification on our part"? If such demands need only to be formulated in order to be seen to be absurd, the conclusion comes home to us again with force that the only demand we can really make is one for fair play and justice.

There is nothing wrong with competition as such, for it is merely a necessary form of sifting with a view to obtaining a proper adjustment of each man to his place in life. That it works perfectly to that end, no one would care to pretend; but it has that end in view,

and accomplishes it to a measurable extent. Without competition in some form there would be no adaptation, and society would relapse into a state of chaos. If there is adaptation to-day throughout the whole range of the organic world, it is because competition has been at work from the very beginning of things. It is not necessary to deny that competition has been and is attended by many evils; but it will be found on examination that these evils are generally of a character to impair the competition and render it more or less illusory. The trouble in these cases is not with the principle of competition, but with the frauds of one kind or another by which it has been vitiated—acts that are in direct violation of the golden rule, because they are such as no man would wish to have perpetrated on himself. As applied to competition, the golden rule demands an honorable observance of the conditions, expressed and implied, of every competition: it requires that every competitor shall do by every other as he would himself be done by.

Apart, however, from fraudulent competition it may be admitted that in some cases parties compete who might well refrain from doing so. There is a passage in Mr. Spencer's Principles of Morality (vol. ii, page 282) which bears directly on this point. "In its application," he says, "to cases of this kind the popular maxim, 'Live and let live,' may be accepted as embodying a truth. Any one who, by command of great capital or superior business capacity, is enabled to beat others who carry on the same business, is enjoined by the principle of negative beneficence to restrain his business activities when his own wants and those of his belongings have been abundantly filled, so that others, occupied as he is, may fulfill their wants also, though in smaller measure." There is something, however, to be said on behalf of those who do not "restrain their business activities" at the point mentioned by Mr. Spencer. In the first place, the capitalist need not waste his money on senseless luxury and ostentation, but may employ it in judicious enterprises for the general good. In the second place, by staying in business he gives the public the benefit of his superior methods, instead of leaving the field to those who, on the whole, would not, it may be assumed, carry on business so satisfactorily—possibly not deal as generously or humanely with the persons whom they employ as he is able to do with those whom he employs. Evidently, it is very difficult to draw a line at the exact point where a given individual should withdraw from competition. The question for the individual concerned is how he can best discharge his obligations to society—how he can do most good to society—and it seems to us that, in some cases at least, this requirement would most fully be met by his continuing to direct the business which he has organized on a sound basis, and is carrying on to the satisfaction and benefit of a large portion of the public. The golden rule—the spirit of it, at least—is not violated so long as, to the best of a man's judgment, what he does is, in the widest sense, for the public good. We fail, therefore, to find any radical contradiction, or indeed any contradiction at all, between the principle of competition and the maxim to which we have so often referred. We have only to think for one moment of what the world would be in the complete absence of competition—in other words, in the absence of all means for selecting the fit and rejecting the unfit or the less fit—in order to see that competition in itself is not and can not be an evil. That

evils attach themselves to it signifies nothing more than that human society is as yet imperfect.

THE SCIENTIFIC TEMPER AND THE NEED OF THE TIMES.

A GOOD illustration of the true scientific temper is furnished in some extracts from the correspondence of James Watt given by Prof. T. E. Thorpe in the Watt memorial lecture delivered by him not many weeks ago. Watt and Cavendish, toward the end of the last century, had both been experimenting and theorizing upon the composition of water. A friend writing to Watt gave him an extract from a paper by Cavendish, and hinted, unjustly, that the latter was making unacknowledged use of Watt's work. The latter's reply was worthy of a true man of science: "On the slight glance I have been able to give to your extract of the paper, I think his theory very different from mine; which of the two is the right one I can not say; his is more likely to be so, as he has made many more experiments and consequently has more facts to argue upon." Again the great discoverer refers to his general diffidence of character. "I am diffident," he says, "because I am seldom certain I am in the right, and because I pay respect to the opinions of others where I think they may merit it." If Science was always served in this spirit, she would have no reason to complain of her devotees, nor would there be any justification for the opposition which the latter, it must be allowed, sometimes excite.

What is principally wanted in the domain of scientific inquiry, as everywhere else, is the spirit of justice. That spirit will prevent a man from appropriating without acknowledgment the labors of others, and also from looking with disfavor on the work of others because it does not tend to support some theory to which he is personally wedded. Men worthy of the scientific calling will recognize that truth is above all, that it is a privilege and an honor to be engaged in its service, and that to make self-glorification the chief end of one's labors is to be unfaithful to the cause of truth and to bring reproach on the profession of science. The scientific world is to be congratulated, upon the general freedom from personal aims and views which its representative men display. The example of Darwin in this respect was of inestimable value. Here was a man engaged in working out a theory of the utmost importance, and, after all abatements are made, of the highest originality. If any man could have been pardoned for being insensible to the objections raised to his theory, or to the weight which might properly be claimed for the opposite views of others, it was he. Yet no man was ever more ready to have his work criticised, no man ever tried with more obvious sincerity to place himself at the point of view of his critics so that he might see the full force of what they had to urge. We hardly think we are mistaken in believing that scientific controversy has shown less tendency to be acrimonious, and a stronger tendency to be just and generous, since the publication of Darwin's Life and Letters.

In these troublous times of contending factions and international jealousies, the very highest service to society will be rendered by that body of men, whoever they may be, who shall most signally exhibit in their words and conduct a love for truth and a desire for justice; who shall stand out most resolutely against the shibboleths of party and

the clamors of excited multitudes; who shall most effectively represent and uphold the permanent and universal interests of humanity against the narrower views of national self-love or the gratification of ephemeral passions. If the question is asked, Who shall these be? we answer that we know none fitter to render this service to society and the world than the true followers of science everywhere. We hope and trust they will recognize their mission and all its vast possibilities.

A VICTIM OF MILITARISM.

If the Dreyfus incident, coupled with the Zola trial, has made plain the fact that France is a military despotism pure and simple, it has not been without value. Because it has a constitution, a president, a legislature elected by universal suffrage, and other simulations of republican institutions, most people, particularly in the United States, have thought it a republic worthy of their sympathy. How often have they congratulated it upon its resistance to the allurements of the one-man power and its check to the advent of some military hero like MacMahon or Boulanger to the seat of an absolute executive! The spectacle has led some of them, especially gifted with the power of prophecy, to declare that free institutions have become so firmly established in France that the restoration of the monarchy can never occur.

But persons able to look beyond the form of government, and to detect the substance that it really represents, know full well that free institutions, properly speaking, have not existed in France for several hundred years. While the Revolution made sad havoc with some of the most characteristic features of the old *régime*, it did not vouchsafe the French people the personal freedom, the essence of free institutions, with which their ill-informed friends in this country have credited them. During the long peace that preceded that appalling event, a great change, as may be seen in De Tocqueville's masterly study of that period, had come over the pitiless despotism that culminated under the reign of Louis XIV. To be sure, the laws were just as ferocious as ever, but they were not enforced with the old-time vigor. The governing classes were not so cruelly indifferent to the classes governed. Indeed, it seemed as if France might as easily and as directly as England had done after the Revolution of 1688 pass under a constitutional *régime* and its people become as free and prosperous as those of its neighbor across the channel.

But this piece of good fortune was not destined to come to that most unhappy country. The anarchy of the Revolution not only destroyed the work of the beneficent influences that promised a complete social and political regeneration, but riveted upon the French people a despotism even more intolerable in some respects than that from which they had escaped. Called upon to restore order and thus prevent the threatened dissolution of society, Napoleon made use of all those agencies so natural and congenial to despots. Instead of trying to establish those institutions that would enable his countrymen to govern themselves, he established those institutions only that would enable him to govern them. He felt that they had no more capacity for self government than children. He knew that if he could tickle their fancy with the thought that they were again the dominant power in Europe they would not care whether they were governed from Paris, as under the

old *régime*, or by their own local assemblies, as had been the case before the growth of the monarchy had deprived them of every semblance of liberty. The justification of his contemptuous opinion of them is to be found in the maintenance to this day of the administrative and judicial despotism that he created—a despotism that Mr. Bodley, the latest and ablest writer on France, believes to be indispensable to their welfare.

Severe as this judgment is, there is evidence on every hand to warrant it. A people fit for freedom would not endure for a moment the crushing bureaucratic system that regulates almost every activity of the Frenchman from the cradle to the grave and helps to saddle him with a burden of taxation greater even than that of the old monarchy. They would destroy at once a judicial system based upon the atrocious assumption that a man is guilty until his innocence has been established. The secret proceedings by which Dreyfus was convicted would be repugnant beyond their endurance. Were they not animated by the spirit that characterizes the victims of despotism they would never maintain a great standing army for the sole purpose of *revanche* nor permit it to dictate to them what the interests of the state require. The punishment of a man like Zola, whose sole offense is that he has dared to beard the dragon of militarism, and lift up his voice in behalf of a man that he believes to be most cruelly wronged, would appeal to their chivalrous sentiments, and instead of trying to mob him they would side with him against the despotism that is demoralizing and crushing them. Finally, an alliance with a power so hostile to every form of freedom as Russia would seem to them an unspeakable disgrace if not a crime against civilization.

In the face of such evidence as this of the unfitness of Frenchmen for freedom, evidence that has extorted from Jules Lemaître the confession that he is almost ashamed to belong to France, it is impossible to doubt the justice of Mr. Bodley's verdict. It is impossible also to believe that anything better is in store for France as long as it is possessed of the militant spirit and insists upon the maintenance of a great standing army to avenge itself upon Germany. Both are absolutely incompatible with freedom and civilized sentiments, and are certain to lead sooner or later to the appearance of another Napoleon to repress the discontent and despair bred of the hard conditions that invariably flow from despotism and onorous taxation. We believe that the only hope for France lies in the complete disbandment of its army, the discontinuance of its efforts to establish a colonial empire, to which few Frenchmen ever go except to get office, the gradual diminution of its bureaucratic despotism, and the growth of personal liberty and private initiative. A continuance of its present policy will exhaust its resources, demoralize its people, and finally make them as easy a prey to a vigorous invader as the unhappy inhabitants of the Celestial Empire.

Scientific Literature.

SPECIAL BOOKS.

In the brief biography with which she prefaces the journals of her grandfather,* Miss *Audubon* believes that she has given the only correct account of his life that has been written. She complains of the manner in which the editor of a previous biography has treated the material furnished by Audubon's widow, and particularly of ascriptions in his notes of vanity and selfishness to the great naturalist, of which she finds no trace; but that in the nine journals "and in the one hundred or so of letters—written under many skies, and in many conditions of life, by a man whose education was wholly French, one of the journals dating as far back as 1822, and some of the letters even earlier—there is not one sentence, one expression, that is other than that of a refined and cultivated gentleman. More than that, there is not one utterance of 'anger, hatred, or malice.'" She has tried only to put Audubon *the man* before her readers, and in his own words so far as possible, "that they may know what he was, not what others thought he was." Since the journals of the Missouri and Labrador journeys came into the author's hands, about twelve years ago, others have been added which had been virtually lost for years. These documents, which furnish her chief sources of information, have been verified and supplemented by every means—by researches in Santo Domingo, New Orleans, and France, and by comparison. The biography of seventy-two pages which precedes the journals includes the sketch of his life to the time of his flatboat journey from Cincinnati to New Orleans in 1820, which Audubon wrote for his sons, and was printed in Scribner's Magazine in 1893, from a manuscript found in a barn on Staten Island. The first of the journals to be printed is the European, recording the story of his journey in 1826 and his visits to Edinburgh, London, and Paris in the interests of his book—a story full of incident and notices of the men distinguished in literature and science whom he met, and shrewd comment. The modest simplicity of his nature is revealed in this journal in a remark that he found his situation in Edinburgh bordering "almost on the miraculous. With scarce one of those qualities necessary to render a man able to pass through the throng of the learned people here, I am positively looked upon by all the professors and many of the principal persons here as a very extraordinary man. I can not comprehend this in the least." The journal of the Labrador journey follows. This trip was made in 1833 for the purpose of procuring birds and making drawings of them for the continuation of the Birds of America. Its interest is that of science and of adventure in regions not even yet familiar. The narrative of the Missouri River journeys in 1843 is now for the first time published in full, the manuscript of the latter part of it, from September 16th to November 6th, having been lost and supposed to be no longer in existence till it was found in August, 1896, in the back of an old secretary where Audubon had put it on his return. This narrative is perhaps the most interesting of all, and is valuable from the point of view of the naturalist,

* Audubon and his Journals. By Maria R. Audubon, with Zoölogical and other Notes by Elliott Coues. Two volumes. New York: Charles Scribner's Sons. Price, $7.50.

and because it describes in their primitive condition and wildness regions and scenes which are being fast invaded and spoiled by civilization. The book is completed by sixty "episodes" or essays and sketches on subjects that came under Audubon's observation or were suggested to him by his adventures, all but one of which were published in the first three volumes of the Ornithological Biographies, but were omitted from the octavo edition of the Birds of America. One—My Style of Drawing Birds—has been added, and two have been omitted as not being of general interest. Of the forty-five pictures and plates, eleven are portraits of Audubon, and nine are facsimiles of diplomas.

Bird Craft—craft about birds; knowledge of them, of their ways, appearance, and song, when and where to look for them, how to approach them, acquaintance with them—these are what Mrs. Mabel Osgood Wright undertakes to convey in the book of that name;* and the undertaking will be found to be crowned with a large degree of success by those who go out into the field intelligently, with sharp sight and the book in hand. A "pocket full of patience" is also prescribed by the author in lieu of the salt of the legend. For naming the birds she gives the scientific terms containing their own definition, which lose force when translated, and the common English names, also recognized by science, which remain practically unchanged. Then there are local names, which are confusing and changing, and need not be treasured up. One does not have to give up the pleasures of acquaintance with birds, even if he lives in the city. Seventy species have been seen in Boston Common, and one hundred and thirty in Central Park. Further, the specimens in the museums are accessible, where they are now usually placed in the attitudes of life. The dweller in the suburbs or in the real country has still greater advantages with living birds. The study of the "*living* bird, in his love songs, his house-building, his haunts, and his migrations," is particularly insisted upon. "The gun that silences the bird voice, and the looting of nests, should be left to the practiced hand of science; you have no excuse for taking life, whether actual or embryonic, as your very ignorance will cause useless slaughter, and the egg-collecting fever of the average boy savors more of the greed of passion than of ornithological ardor." The study of birds is best begun in the spring, when the untrained eye can become gradually accustomed to its new vocation before it is overtaxed, and the birds can be taken in all their moods from the opening of the season on. So Mrs. Wright takes us, and accompanies us in our wanderings in birdland, like a conversing companion, while she does not neglect to give us the technical information we need. It would be hard to speak too well of the almost vitalized bird portraits which Mr. Louis Agassiz Fuertes has furnished in the eighty full-page plates with which the book is adorned.

GENERAL NOTICES.

Inequality and Progress is the title of a rather disappointing volume,† at any rate to the scientist, by *George Harris*, a professor in the Andover Theological Seminary. The position which the author takes—namely, that inequality is an essential to progress,

* Bird Craft: A Field Book of Two Hundred Song, Game, and Water Birds. By Mabel Osgood Wright. New York: The Macmillan Company. Pp. 317. Price, $2.50.

† Inequality and Progress. By George Harris. Boston and New York: Houghton, Mifflin & Co. Pp. 164.

and that, instead of attempting to equalize things, we should rather strive in an opposite direction—is a thoroughly rational one; but the many facts derivable from psychology, from history, and kindred sciences, and the application of these to a system of society and education, the two sciences on which this question of equality chiefly bears, have been but indifferently handled by Mr. Harris. In fact, to be just, the author announces in his preface that the volume is not intended as a philosophical or scientific exposition, but is rather "a series of observations and reflections which from various points of view exhibit the variety and the unity of men." Notwithstanding these faults there is much good thought in the volume and many well-taken points. The question is one of great importance, bearing as it does directly on the socialistic theories of society, and, as Mr. Harris says, that charmed word "equality" seems to have blinded our people to the absurdity of the doctrine of which it is the watchword. The first few chapters of the volume are devoted to showing the essential inequality of the natural arrangement of things and the impotency of human efforts to bring about an artificial equality. For instance, equality of opportunity in education is shown to be a chimera, not only because of the great variation in individual ability, so that with equal opportunities any two students will graduate with widely differing content of knowledge, but also because what is the most stimulating and appropriate education for one student may have an entirely opposite effect on the next. Inequality or, as the author prefers, variety is next shown to be an essential to progress, and, in fact, one of the results of the latter, and successful social life to depend on the rule of the superior portion of the community, which is again inequality. The chapters ramble on under such titles as Two Kinds of Discontent, Admiration and Inspiration, The Progression of Ideals, until the volume is finally closed by one on Christianity and Inequality. The great importance of a clear understanding of this question, especially in the United States, where we seem to be tending steadily toward socialism, and the slight attention which the inequality side has received during recent years, give Dr. Harris's book a value which perhaps its intrinsic merits do not justify. The reader will gather some new thoughts from its perusal, and may be stimulated to a further study of the question.

Mr. *Edmund Gosse's* principal aim in composing his *Short History of Modern English Literature** was to show the movement of the subject. He desired above all else to give the reader, whether familiar with the books mentioned or not, "a feeling of the evolution of English literature in the primary sense of the term, the disentanglement of the skein, the slow and regular unwinding, down succeeding generations, of the threads of literary expression." Considering the nature of the subject and the multitude of temptations to stop on the way to expatiate and moralize, his success in giving the idea of a sense of flow is remarkable. A feeling of movement is what the reader experiences in reading the rapid sketches. There are periods, indeed—the Age of Chaucer, the Close of the Middle Ages, the Age of Elizabeth, the Decline, and so on, down to the Age of Tennyson—just as there are stations on the railroad journey, but between the stops the train goes on with power and unslacking speed. Beginning with the Romances of Chivalry, authors and books are called up in succession, with hardly more than a page to each, delineated or characterized in only a few lines or in an epigram, as it were, yet with such vigor and skill as to leave upon the mind the impression of a picture from life. The leaders of scientific thought of the present age, as of past ages, are included in the sketches: Mill, "skeptical and dry, precise and plain," whose works "inspire respect but do not attract new generations of readers"; Darwin, "one of the great artificers of human thought," destined to perform one of the most stirring and inspiring acts ever carried out by a single intelligence"; Spencer, in whose Principles of Psychology, as his friends point out, "the theory of Darwin was foreseen," who has made a deeper impression on foreign thought and is more widely known throughout Europe than any other Englishman of the present age, and whose themes "have exercised a stimu-

* A Short History of Modern English Literature. By Edmund Gosse. New York: D. Appleton and Company. Pp. 416. Price, $1.50.

lating effect over almost every native author of the last twenty years"; Tyndall, who "conciliated critical opinion by the courage with which he insisted on the value of imagination in the pursuit of scientific inquiry"; and Huxley, master of a purer and manlier style, who his whole life through "was attacking the enemies of thought, as he conceived them, and defending the pioneers of evolution."

In Dr. *Francis Warner's Study of Children*,* the practical purpose is very evident, to inform parents and teachers how they should study the idiosyncrasies of children and the relations of their special physical conditions to the psychological symptoms, to the end that they may treat their cases judiciously. If a child is restless, troublesome, even bad, there is most probably a cause in its physical conditions or surroundings for its peculiar disposition. The teacher should seek to ascertain that cause, and so conduct the inquiry that the child shall not be embarrassed or disturbed by knowing his purpose. One of the first principles announced in the book is that "we must remember that children differ greatly in strength and in mental faculty; education should therefore be adapted to the special needs of the individuals. As there are many classes and varieties of children, whose needs must be studied, while bodily strength and mental faculty differ with the age and surrounding, "child study must be a matter of primary interest to the teacher and others engaged in the care of children as affording a basis for the methods of education; giving a source of perpetual interest to work in school, an interest in the individual child, and a means of working out, in practice, the best that can be done with the child in various phases of life. . . . Observation shows the child's strong points which should be cultivated as well as his weak ones which must be combated." The chapters on the physiology and general conditions of the child are followed by others on points and methods of observation—what to look for and how—and then by general instructions on methods of treatment and training. The almost innumerable varieties of cases may be arranged in groups, for which the general principles of treatment and study are suggested. These are illustrated by detailed accounts of typical cases. The author, an eminent writer in this line of study, has had special facilities for preparing for this particular work; having, as one of a committee of the British Medical Association, to study school children as to their physical and mental states, examined one hundred thousand children upon a fixed plan, and taken copious notes of what he found.

Miss *Merriam* seeks in her *Birds of Village and Field** to aid persons who know little or nothing of birds in identifying and studying those they see. The presence among us of larger numbers of them than we usually suspect makes the study of a considerable variety of birds practically possible to any one. We do not have to go away off to seek them. They throng around our very doors; prefer the vicinity of the habitations of men to wild spots; and, shy as they are, reveal themselves to those who look patiently and carefully for them. From seventy to nearly a hundred species a year have been known to resort to private grounds where records are kept. Miss Merriam furnishes an untechnical key, and as simple as may be to the identification of these birds. A "field color key" describes all the various markings that are likely to be seen, in clear, concise terms; and each particular marking is referred to the page in the book where the bird bearing it is described. The descriptions are lively, interesting, bear upon the habits and appearance of the birds, and give many hints as to how we may enjoy them to the best advantage, and even entice them to make their homes among us; and they include a large number of species with the distinctions between them plainly marked, and numerous illustrations, large and small, of special features.

The selection of counties by the Geological Survey of Iowa† for special examina-

* The Study of Children and their School Training. By Francis Warner, M. D. New York: The Macmillan Company. Pp. 264. Price, $1.

* Birds of Village and Field. A Bird Book for Beginners. By Florence Merriam. Boston and New York: Houghton, Mifflin & Co. Pp. 406. Price, $2.

† Iowa Geological Survey, Vol. II. Annual Report, 1896, with accompanying papers. Samuel Calvin, State Geologist; A. G Leonard, assistant. Des Moines, pp. 557, with maps.

tion in 1896 was guided by the consideration of bringing to the attention of the public geological deposits of great importance, and of choosing such locations as would elucidate as large a number of geological problems as possible. Six counties are described and mapped as geologically important in respect to indurated rocks and superficial deposits, and as being, therefore, of great practical interest to the people of the State. The soils are treated as economically the most important formations. Tests of building stones have been completed and are ready for publication. Attention corresponding to their importance was given to the study of the coal beds. It was incidentally demonstrated that the succession of Pleistocene deposits is more complete and more clearly indicated in Iowa than in any other corresponding area of this continent so far studied. The State Geologist is gratified to represent that the publications of the survey are being more and more appreciated, and are received by the people of the State as well as by men of science everywhere with increasing favor. Requests for copies of the reports are very numerous and indicate a widespread interest. High schools in counties already reported upon have introduced the separate county reports as works to be read by the pupils studying geology, and newspapers publish summaries of reports of local interest.

The object of Prof. *L. H. Bailey's Lessons with Plants* * is well indicated by its secondary title; it is to suggest methods of Nature study; not to teach a science, but only to indicate a way in which plants may be studied and the subject taught. The lessons are an extension of the ideas embodied in the Nature Study Leaflets issued for the use of teachers by the College of Agriculture of Cornell University; while these leaflets are, in turn, the direct growth of "observation lessons" which were a part of the instruction given in itinerant schools of horticulture in the State of New York. When the book is used by the teacher, he is supposed to master an observation, collect specimens proving or illustrating it, and teach his pupils from the specimens. If the pupil consults it, he collects specimens and recites from them, not from the book. Pupils will not do this so well by themselves as when under the inspiration of the teacher; for while it is not true that only those things are useful which one finds out for himself—else we could make little progress—"the pupil should find out something for himself, and, more than all, he should enjoy the finding of it." The lessons teach and picture what are to be found in twigs and buds, leaves and foliage, flowers, fruits, the propagation, behavior, and habits, and the kinds of plants; while the appendix contains suggestions on pedagogical methods, books, classification, evolution, the interpretation of Nature, the growing of plants, and a glossary.

Mr. Edward P. Thompson's narrative of the exploration of the *Cave of Loltun*, near Labná, Yucatan, in 1890–'91, is given as No. 2, Volume I, of the Memoirs of the Peabody Museum of American Archæology and Ethnology of Harvard University. The cave was excavated through all the deposits that had been made in it "down to and into the crystalline surface of the ancient floor itself." Numerous interesting remains of man and human life were found, inscriptions and specimens of art, but nothing indicative of primitive savagery. Typical examples of these relics are represented in figures in the text and in large photographic plates.

D. T. Day's twelfth *Report on the Mineral Resources of the United States* (1895) appears in a somewhat different form from the previous reports, the pages being enlarged, and is published in two volumes as Part III of the seventeenth annual report of the Geological Survey. In it the scope has been limited more than in previous reports to the statistics of production of the minerals and statements of the conditions of their occurrence, and less space has been devoted to the technical features of their development.

From the United States Geological Survey we have the monographs from the twenty-fifth to the twenty-eighth volume, inclusive. The twenty-fifth volume comprises the survey of the former bed of the very large *Lake Agassiz*, which occupied the Red River Val-

* Lessons with Plants. Suggestions for Seeing and Interpreting some of the Common Forms of Vegetation. By L. H. Bailey, with Delineations from Nature by W. S. Haldsworth. New York: The Macmillan Company. Pp. 491. Price, $1.10.

ley during the Glacial period, by *Warren Upham*, who prosecuted the work, under the direction of Prof. T. C. Chamberlin, during four years in Minnesota and North Dakota, and by special arrangement with the authorities concerned, in Manitoba. The Canadian part of the lake has also been examined by Dr. G. M. Dawson.

The twenty-sixth volume is an account of the *Amboy Clays*, New Jersey, by Dr. *J. S. Newberry*, completed and revised, after the author became unable to put the finishing touches upon it, by Arthur Hollick, who has also prefixed to the work a brief review of Dr. Newberry's contributions to fossil botany. The Amboy clays are a part of the Cretaceous formation, extending across the State of New Jersey from the Delaware to the southern part of Staten Island, and are the seat of large potteries. Dr. Newberry describes one hundred and fifty-six species of plants found in these clays, mostly from the middle bed in the series, with remains of, perhaps, thirty other species, not clearly identified.

Volume twenty-seven is the *Geology of the Denver Basin, Colorado*, by *S. F. Emmons, Whitman Cross*, and *G. H. Eldridge*. The publication of this report has been considerably delayed, as is explained in the preface, by discoveries made while the survey was going on that made further researches desirable. The importance of these discoveries is indicated when it is said that they bear upon the determination of the age of the Rocky Mountain uplift and the line between Cretaceous and Tertiary formations in general, and upon the recognition of coal-bearing horizons throughout the Rocky Mountain region. The area specially treated in the report is regarded as a type of the "foothill belt" of the Great Plains.

The twenty-eighth volume is the final report of the *Marquette Iron-bearing District of Michigan*, by *C. R. Van Hise* and *W. S. Bayley*, with an atlas, including also a chapter on the Republic Trough, by H. L. Smith.

The *Transactions of the Fourteenth Annual Meeting of the American Climatological Association*, Washington, 1897, includes, besides the address of President E. F. Ingalls, on The Antiseptic Treatment and the Limitation of Climatic Treatment of Pulmonary Tuberculosis, twenty-one papers by physicians on subjects related to health, climate, disease, and cure. One hundred and twenty-one members attended the meeting. The meeting for 1898 is to be held in Bethlehem, N. H.

The International American Conference, or Pan-American Congress, as it is more commonly known, in 1890, recommended the adoption by the Governments represented in it, of a common nomenclature designating in alphabetical order in equivalent terms, in English, Portuguese, and Spanish, the commodities on which import duties are levied, to be used in all transactions in which those duties are in question and in business documents. The nomenclature has been prepared, and is now published by the Bureau of American Republics at the Government Printing Office, Washington, as the *Code of International Nomenclature* of that bureau. It consists of three quarto volumes, giving the terms in three orders—English, Spanish, and Portuguese; Spanish, English, and Portuguese; and Portuguese, Spanish, and English, a volume being devoted to each order. The vocabularies embrace more than twenty thousand commercial terms used in the Latin-American trade, in each of the three languages; and are adapted to the counting room, the factory, the shipping office, customs offices, courts, to the use of economists and statisticians, and of all persons directly interested in the business relations of the states of the Western hemisphere. The book will no doubt be of great use and extremely valuable to publicists, business men, and students, and may easily justify its existence; but why the publication of it should be imposed upon the Government rather than left to private enterprise is a matter which one imbued with American notions of the functions of government, and particularly of those of the Government of the United States, will find it hard to comprehend.

In the ninth special report of the Commissioner of Labor a social and economic study of *The Italians in Chicago* is presented. A very minute analysis is given, under twenty headings, of the social and economical conditions, literacy and illiteracy, nativity, conjugal state, families, school attendance and other facts, by sex, nativity, age, etc. It includes data for 6,773 persons in all, 4,493 of whom were born in Italy, grouped into 1,348 fami-

lies. The average size of these families is 5.02 persons each. As for occupation, 60.68 per cent of all the persons were of the unproductive class; less than one per cent were engaged in agriculture, fisheries, and mining, or professional work; 17.78 per cent in domestic and personal service; 10.14 per cent in trade and transportation; 2.78 per cent in some work in addition to their household duties; and 1.65 in some work besides going to school. Special remark is made upon the small proportion of women working at gainful occupations. The average weekly earnings of persons reporting were $5.93¼, the highest $7.64¼, and the average number of hours per week was fifty-nine. The number of illiterate persons was 2,752. Questions were asked of the housekeepers whether they had baked bread, spun, sewed, knit stockings, or worked in the fields, in this country and in Italy. In each case a considerable number were found who had done one or more of these things in Italy and ceased to do them here. Three hundred and five persons had sent the aggregate amount of $19,384, or an average of $63.56 each, to bring relatives from Italy; 9 had invested $2,440 in land in Italy and 76 had invested $260,665—or an average of $3,430 each, in land in the United States. Three hundred and ten—271 men and 39 women—had visited Italy since coming here—some of them twice, three, four, and even five times.

We have from George H. Barton, of the Massachusetts Institute of Technology, *Report B on the Scientific Work of the Boston Party of the Sixth Peary Expedition to Greenland*, detailing glacial observations in the Umanak District, Greenland, well illustrated.

In *Crusoe's Island*, of Appletons' Home-Reading Book Series, we have geography, travel, criticism, natural history, adventure, and notes of human traits, all combined in a single small, interesting, and instructive volume. The author, *Frederick A. Ober*, having visited the Antilles to study birds under the auspices of the Smithsonian Institution, became desirous of learning more about those attractive regions. With this desire occurred to him the determination to search out the truth respecting Robinson Crusoe, or rather respecting the spot which Defoe had in view in describing the scene of his great story. In this book he proffers a description of what he believes is "the veritable island in which Robinson Crusoe lived his lonely life, the scene of his wreck, his cave, his bower, his Man Friday; the birds and trees he saw or ought to have seen, together with the author's own experience." Various quotations from Crusoe have been used, which, together with the internal evidence of the book itself, seem to show conclusively that "the island of his exile was not Juan Fernandez in the Pacific Ocean, but Tobago in the Caribbean Sea, not far distant from the north coast of South America"; and Man Friday was a Carib from Trinidad. This, however, is not all the book. The Nature sketches, the tropical pictures, the descriptions of birds, the account of the Caribs, and the adventures, constitute of themselves a story of rare interest.

PUBLICATIONS RECEIVED.

Agricultural Experiment Stations. Reports and Bulletins. Cornell University: No. 144. Notes on Spraying and on the San José Scale. By H. P. Gould. Pp. 16; No. 145. Some Important Pear Diseases. By B. M. Duggar. Pp. 32.—Delaware College: No. 36. Potash. Pp. 24; No. 38. Anthrax. Pp. 16; No. 39. Sorghum. By C. L. Penny. Pp. 23.—Michigan State Agricultural College: Nos. 151-153. Small Fruits and Vegetables. Pp. 96; Nos. 155 and 156. Spraying, and Nurseries and Orchards. Pp. 32; No. 154. Corn Raising. By C. D. Smith, Director. Pp. 24.—Montana: No. 15. Larkspur Poisoning of Sheep. Pp. 16, with plates.—New Hampshire College: No. 48. Ninth Annual Report. By Charles S. Murkland. Pp. 32; No. 49. Inspection of Fertilizers. Pp. 18.—Ohio: No. 84. Sixteenth Annual Report. Pp. 72; No. 90. Sugar-Beet Investigations. Pp. 42; Newspaper Bulletin on Arsenite of Soda. Pp. 2.—Purdue University: No. 68. The Sugar Beet in Indiana; No. 69. Insecticides, Fungicides, and Spraying. Pp. 8.—United States Department of Agriculture: Recent Laws against Injurious Insects, etc By L. O. Howard, entomologist. Pp. 68; The Cultivated Vetches. Pp. 8; Climate and Crop Service, North Dakota Section. Pp. 8; Miscellaneous Results of the Work of the Division of Entomology. Pp. 100.—University of Illinois: No. 49. The Sugar Beet in Illinois. Pp. 32; No. 50. Cost of Production of Corn and Oats in 1896. Pp. 24.—University of Kansas (Department of Entomology): Scale Insects Injurious to Orchards. Pp. 62.

Bailey, L. H. The Pruning Book, a Monograph of the Pruning and Training of Plants as applied to American Conditions. The Macmillan Company. Pp. 537. $1.50.

Beauchamp, W. M. Polished Stone Weapons used by the New York Aborigines before and during European Occupation. New York State Museum, Albany. Pp. 102.

Blakiston, Son & Co., Philadelphia. Books on Medicine and Allied Sciences published during 1896, 1897, and 1898. Pp. 32.

Bulletins, Reports, and Proceedings. Academy of Natural Sciences of Philadelphia: Nine sheets, 1898.—Astronomical and Physical Society of Toronto: Transactions for 1897, including Report. Pp. 160. $1.—British Columbia: Annual Report of the Minister of Mines for 1897. Pp. 196, with maps.—Iowa Health Bulletin. March, 1898. Pp. 16.—Michigan Monthly Bulletin of Vital Statistics. March, 1898. Pp. 20.—Peabody Museum of American Archæology and Ethnology: Thirty-first Report. Pp. 16.—Scientific Alliance of New York: Report of the Building Committee. December 23, 1897. Pp. 10, with plates.—Society for Psychical Research: Proceedings. February, 1898. Pp. 375. 1 shilling.—Treasury Department, United States: Notice to Mariners. March, 1898. Pp. 12.

Clarke, R. Floyd. The Science of Law and Lawmaking. New York: The Macmillan Company. Pp. 473. $4.

Coues, Elliott. Report of the Floyd Memorial Association. Sioux City, Iowa. Pp. 58.

Davidson, Thomas. Rousseau and Education according to Nature (Great Educators Series). New York: Charles Scribner's Sons. Pp. 253. $1.

Field Columbian Museum, Chicago. Publications: No. 23. List of a Collection of Shells from the Gulf of Aden. By Dr. W. H. Dall. Pp. 3; No. 26. A Bibliography of the Anthropology of Peru. By G. A. Dorsey. Pp. 144; No. 27. Lists of Species of Mammals, principally Rodents, obtained in Iowa, Wyoming, and other States. By D. G. Elliot. Pp. 16.

Hylan, J. P. The Fluctuation of Attention (Monograph Supplement to the Psychological Review). New York: The Macmillan Company. Pp. 78.

Missouri Botanical Garden. Ninth Annual Report of the Director. St. Louis. Pp. 160, with plates.

Oppenheim, Nathan. The Development of the Child. New York: The Macmillan Company. Pp. 296. $1.25.

Ores, Pig Iron, and Steel. Methods for Analysis. Easton, Pa.: Chemical Publishing Company. Pp. 153. $1.

Packard, Alpheus S. A Text-Book of Entomology, including the Anatomy, Physiology, Embryology, and Metamorphosis of Insects. New York: The Macmillan Company. Pp. 729. $4.50.

Reprints. Bell, Alexander G.: The Question of Sign Language and the Utility of Signs in the Instruction of the Deaf. Two papers. Pp. 29; Method of Instructing the Deaf in the United States (Statistics). Pp. 4.—Bolton, Dr. H. Carrington: Iatro-Chemistry in 1897. Pp. 11; Hysterical Chemistry. Pp. 14.—Gillette, C. P.: American Leaf-hoppers of the Subfamily Typhlocibinæ. Pp. 64.—Horsford, Cornelia: Dwellings of the Saga Time in Iceland, Greenland, and Vineland. Pp. 12.—Keyes, C. R.: Use of Local Names in Geology. Pp. 10.—Lumholtz, Carl, and Hrdlicka, Ales: Marked Human Bones from a Prehistoric Tarasco Indian Place in Michoacan, Mexico. Pp. 20, with plates.—Macdougal, Prof. D. T.: The Province and Problems of Plant Physiology. Pp. 12.—Sunderland, J. T.: Christian Missions in India. Pp. 21.—Wyman, Hal C.: Some Cases of Brain Surgery. Pp. 11.

Rollin, H. J. Yetta Ségal. New York: G. W. Dillingham & Co. Pp. 174. $1.50.

Royce, Josiah. Studies of Good and Evil. New York: D. Appleton and Company. Pp. 384. $1.50.

Seward, A. C. Fossil Plants for Students of Botany and Geology. New York: The Macmillan Company (Cambridge University Press, England). Vol. I. Pp. 452. $3.

Smith, Goldwin. Guesses at the Riddle of Existence, etc. New York: The Macmillan Company. Pp. 244. $1.25.

Strasburger, Dr. E.; Noll, Dr. Fritz; Schenck, Dr. H.; and Schimper, Dr. A. F. W. A Text-Book of Botany. Translated from the German by H. C. Porter. New York: The Macmillan Company. Pp. 632. $4.50.

Willey, Freeman Otis. The Laborer and the Capitalist. New York: The Equitable Publishing Company, 145 Chambers Street. Pp. 311. $1.25.

Fragments of Science.

An Old-time Naturalist and his Guests.—A pleasing picture is given in Mrs. W. Pitt Byrnes's Social Hours with Celebrities of the person and home of Charles Waterton, a famous English naturalist and traveler of the former part of the century, a picture of whom astride an alligator is one of the early recollections of the writer. He had constructed in his house, for the mystification of his visitors, an odd figure of the missing link; was distinguished by some harmless eccentricities and affectations, and had a wonderfully intimate knowledge of the habits and proclivities of different animals. By the aid of this trait he seemed to be able to entice within his domain any animal he wished. His method was simply to prepare an attractive and convenient lodging for them suited to their taste. It was soon discovered and taken possession of by those it was intended for. For the accommodation of the starlings on his place he had some holes bored in an old tower, when each was at once occupied and made a nesting place by a family of the birds. "Finding his scheme successful, he next created a couple of towers expressly for the accommodation of these interesting birds, securing them immunity from the inroads of vermin by building them on solid stone pedestals, and with excusable pride he used to show to his guests the successful results of his ingenious arrangement." Many other birds were induced in a similar way to make their home on his estate. Having a place for their reception, the owls flocked to it at once, and "he soon had owls of various species by contriving such abodes as each according to its special habits pre-

ferred, and, having secured them, each colony added a new pleasure to his life." Among other measures for making Walton Hall pleasant for his animal friends, he prohibited the use of any kind of firearm within the grounds. At last, however, the rooks and rabbits became so numerous that it was necessary to hunt them out with guns and dogs. Yet the waterfowl, "of which there was a beautiful variety, . . . floated leisurely away from the noisy reports and seemed to think themselves perfectly secure on the opposite side of the lake; while the herons—perhaps to get a better view of the sport—perched on the highest branches of the trees till the battue was over. This heronry was one of his most successful achievements, accomplished by the simple mode of attraction I have already described . . . One of his keenest enjoyments was to take his guests up to the telescope room, where the instrument was always set in the direction of the heronry, in order that he might the more completely study the habits of its interesting inhabitants, and observe the strange construction of their nests and the curious positions they would assume."

Hygiene of a Natural Life.—A view of the actual conditions of health under a substantially natural manner of living among the natives of Labrador was given by Lord Strathcona and Mount Royal, chancellor of McGill University, in an address before the Middlesex Hospital Medical School. So long, the author says, as the natives keep to their own food and habits—they live largely on meat and fish, always cooked, and upon wild berries and fruits—they generally retain their teeth. But in the case of the natives from the interior, who adopted the food of the white men, they soon lost their teeth, and their lives were often shortened. Although the climate is severe and the summers are short, the country is healthy, and no doubt the open air conduces to freedom from disease. A form of Turkish or rather vapor bath has been in vogue among them as far back as we have any record. They rig up a small tent, put intensely hot stones inside, and pour water upon them, and then take the bath, which is regarded as very beneficial in many complaints. They have decoctions of herbs, and understand the preparation of nourishing foods, which are given in cases of failing strength and vitality. A decoction made from boiling crushed bones and marrow is largely used in cases of lung disease. Amputations are occasionally performed by the natives themselves, or by the European and Canadian residents, in a primitive way. What may be termed a primitive and somewhat rude form of antiseptic treatment was practiced in the district many years before Lord Lister introduced his great discovery. For the treatment of wounds, ulcerated sores, etc., a pulp was made by boiling the inner bark of the juniper tree. The liquor which resulted was used for washing and treating the wounds, and the bark, beaten into a plastic, pliable mass, was applied, after the thorough cleansing of the wound, so as to form a soft cushion, bending itself to every inequality of the sore. Scrupulous cleanliness was observed, and fresh material was used for every application. The incident shows that while discoveries and inventions are being made in centers of the highest civilization, they may yet be practiced in a primitive way in distant localities hard of access, while the world of science is still unaware of them.

Free Traveling Libraries in Wisconsin.—The institution of Free Traveling Libraries in Wisconsin was suggested to the Hon. J. H. Stout by the observation that the excellent public library at Menomonie was used by only a very small proportion of the country people entitled to draw upon it. Finding that the failure to take out books in larger numbers was due to the difficulty of getting and returning them and not to lack of appreciation of them, he procured five hundred books well chosen for popular reading, divided them into sixteen small libraries each containing thirty volumes, and distributed them, with rules and directions concerning the use of them, at suitable places in the country, to be sent, when that constituency had done with them, to some other, when one of the other libraries should take their place—and so on. The libraries went into operation in May, 1896. The demand that arose for the books encouraged the founder to make additions, and now there are thirty-seven traveling libraries in Dunn County, thirty-four

of which are in active service, two are kept for reserves, and one has been exhibited in many parts of the State as a sample. Mr. Frank A. Hutchins, in his account of the libraries, says that the eagerness of the public for them "is touching, and as evident among people who read little as among the more intelligent." Illiterate parents seemed to know, almost by instinct, that if their children could read good books freely, they would be likely to be better men and women, and to hold better stations in life. Even rough men acknowledged the value of good literature. One place that had been described as a "hell hole" took the books notwithstanding its bad reputation, and in a few weeks showed double the circulation of its "scoffing neighbor." A storekeeper took in a library, hoping it would help get the loafing boys out of his store. "They are good boys," he said, "except for their habit of loafing, but they haven't anything to do and I can't turn them out." Of the thirty-four stations in Dunn County, twenty-two are in farmhouses, nine in post offices, two in country stores, and one in a railway station. The success of the libraries in all parts of the county was immediate and the interest has continued to grow, an increase in the circulation being mentioned in each succeeding report. Other places have taken up the idea, and there are now one hundred traveling libraries at work in Wisconsin.

A Tornado's Work on Trees.—After the tornado that swept a part of the city of St. Louis, May 27, 1896, a study was made of the injury done to the trees, the general results of which, with some of the technical details, were communicated to the Academy of Sciences by Mr. Hermann von Schrenck. Hardly a tree escaped injury of some kind, except possibly a few cypresses, which with their conical forms yielded to the force of the wind. Some of the uprooted maples and elms were simply turned over, and when straightened up a few days afterward resumed their former growth. Most of them, however, lost all their principal branches, and some were reduced to the trunk with perhaps two forks. These were trimmed up to look like very heavily pollarded trees. The new leaves were in their most active growth, and the destruction of them was very marked. The leaves were wet, and the injuries were evidently largely due to rubbing against branches. Flying missiles of various kinds aided in the destruction. "Grains of sand and small bits of wood and stone, flying through the air at velocities ranging from fifty to eighty miles per hour, were well able to shred the tender leaves." Many trees were left with hardly a sound leaf on their remaining branches. Other injuries were inflicted, not so evident as those to branches and leaves. "Numerous trees had trunks of sufficient elasticity to bend before the force of the wind without breaking. In swaying to and fro, the bark was considerably stretched on one side and compressed on the opposite side, and in the next instant the conditions were reversed. When this took place repeatedly, the bark was torn horizontally for several feet, sometimes on but one side, more often on both. The violent wrenching of a tree with a large top, like the maple, produced considerable strain upon the bark, especially when the force applied was a twisting one. When the strain was too great, the bark came off in sheets, or split longitudinally. . . . In many trees there was no outward sign of this injury for several months; not until the loosened bark died did any shrinkage take place, but then it split and curled up." Wounds made by flying pieces of wood and slate cutting away bark or imbedding themselves in the wood healed rapidly. In the course of June the axillary buds for 1897 on such twigs as were left began to unfold, and produced new leaves; and by September a growth of six inches or more had been made from these buds. In trees that had no such buds to fall back upon, numerous adventitious buds broke out from all parts of the trunk and remaining larger branches. In many of the most injured trees this growth was very small, and they failed to revive the next spring.

Archæology a True Science.—Following Sir John Evans's presidential address in the British Association on the Antiquity of Man, Lord Kelvin spoke for the claims of archæology to be placed among the strict sciences. There is too much tendency among scientific men, he said, to include under the term true science nothing but dead physical facts and certain definite branches of biological knowl-

edge. To himself it had never seemed at all intelligible how geology could cease to be scientific when it touched upon human history. The fact that there was a poet or historian to narrate the history of a period did not take away this scientific character. We must never forget that geology, going to the earliest period of time when life first appeared upon the earth, brought us down to the present day. Volcanic changes of the earth such as are taking place now, remains of ancient action such as the marvelous lake of lava in Hawaii, are just as much subjects of geological research as if no reporter or narrator existed to record their history. The archæologist of mediæval history and the archæologist who has gone before human history and has helped the geologist to bring into definite connection the epochs of the world's existence, must all be welcomed as scientific geologists.

Adulteration with Antiseptics.—Special attention is given in the second report on Food Products of the Connecticut Agricultural Experiment Station to adulteration by antiseptics. These substances are for the most part, when taken in sufficient quantities and degrees of concentration, poisonous; and whether any one of them shall operate as a harmless preventive or remedy, or as an unhealthful or even fatal poison, to the consumer of food and drink containing it, depends upon the quantity and frequency of the dose. A number of successful food preservatives—such as sugar, alcohol, vinegar, lactic acid, salt, smoke, spices, and "sweet herbs"—are at once recognizable and known by their taste or odor. They are all commonly reckoned harmless to sound digestion and good health when taken in moderation, and are reputed to be unhealthful to certain classes of invalids, or when taken in excess. Within about twenty years several powerful antiseptics have come into very extensive and more or less surreptitious use, that are not recognizable in food or drinks by either taste or odor. These are salicylic acid, benzoic acid, and borax or boric acid. Salicylic acid, the essential ingredient of wintergreen and oil of birch, and benzoic acid, which exists in various balsams and gum resins, in the oils of marjoram, cassia, cinnamon, and cloves, in vanilla, sweet flag, plums, and cranberries, are efficacious only in the free state. Borax and boric acid are effective, cheap, odorless, and tasteless when mixed with food, and are much used. The testimony is conflicting as to the effect of the continued and frequent use of these preservatives upon the health of consumers. There are some falsifications which the public have long tolerated and people are careless of, as those of mustard, which is now sometimes hard to find strong enough to make a plaster of. "This kind of adulteration and the lying statements by which it is forced on the public have so habituated people to poor articles and low prices that purchasers of the recent generations probably do not know, in many cases, what genuine goods are, and do not realize what waste of money as well as loss of satisfaction there is in buying so-called 'cheap' wares, for which, considering the real value of the articles, they actually pay an exorbitant price."

Variety in Tobacco Pipes.—The pipe is treated by the Baron de Watteville as on the point of vanishing from use, being about to be superseded by the cigarette; even the Dutch, our author says, are abandoning their pipes and smoking paper-wrapped stems instead. There is evidently great exaggeration in this assertion, for we meet evidence daily in groups of fashionable smokers that the pipe has not disappeared, and is in no danger of going out of use. M. de Watteville's study of pipes nevertheless presents many features of interest. Consider the materials of which they are made, and the variety in their shapes. White clay is the predominant material for the bowls in England and the adjacent continental countries, red clay in the Mediterranean basin, black clay in Africa, porcelain and elm root in the Germanic countries, stone among some savage tribes, and wood almost everywhere; but where wood is not to be obtained, as in the arctic regions, fossil ivory, whales' bones, or walrus tusks are used. The stems are of wood or horn, of more or less artistic shapes among Europeans; rough ox horn in South Africa, antelope horn along the sources of the Nile, cherry in Hungary and Armenia, jasmine in Persia, bamboo in hot countries, gold, silver, or wood or leather trimmed with precious materials for the lips of wealthy Orientals,

and reeds for the poor; and all draw and puff their smoke with equal pleasure. The form and size of the bowls depend more or less on what is smoked, and the fashion of smoking. And what is smoked? Tobacco by the Europeans of Europe and America—when it is not something else under that name. And these are as nothing in comparison with the hundreds of millions of Asiatics and other hundreds of millions of Africans who use opium, hemp, toadstools, rose leaves, tea leaves, cabbage leaves, and what not. We might say that everything is smoked, except tobacco. While tobacco pipes are generally of moderate capacity, some German and Danish smokers use pipe bowls nine or ten inches long and wide in proportion, and there are pipes in Africa and Damascus that will hold nearly a pound. There are pipes of two and more bowls, some Dutch seventeenth-century pipes with six and seven bowls, each having an elaborately shaped stem, being mentioned by M. de Watteville; and other pipes having several stems. The stems vary in length from the stubby pipe that the workman can smoke as he works, to the elongated six- or eight-foot coiled tubes of the Oriental nargilehs. The length of the stem is partly a matter of climate: short stems for cold countries, long for hot ones. The decorations of pipes are subject to the caprices of fancy and the prevailing fashion. Some Oriental pipes are fairly worth their weight in gold by virtue of the jewels with which they are adorned. They often bear coats of arms or a political device, like a cigar holder of the German Kulturkampf period, on which Bismarck was represented as a shoemaker. At every inhalation the figure raised its right arm and brought its hammer heavily down upon the back of a priest.

History in Minerals.—Palæomineralogy is the name which M. J. Thoulet has given to the study of the traces that events have left upon minerals, by means of which we may learn facts in the past history of the rock, whether it be a few days or months or thousands of years old. It aims to reconstitute the geography of the earth in its most remote epochs, in attempting which we have to take cognizance of the most minute details, as we would do in exploring a hitherto unknown island. The methods of this branch of investigation are illustrated by the studies of Sorby on the formation of liquid inclusions in crystals; by those of Des Cloiseaux and Maillard on the optical deformation of minerals, as a result of which we are able to ascertain whether the feldspar in the rocks has or has not been subjected to a red heat. Other experiments, physical and mechanical, permit us to read similar lessons in the history of minerals. Thus Daubrée, after studying the effects of wearing upon pebbles, remarked that "every grain of sand bears its history inscribed upon it." In this way M. Redgers traced the origin of the dunes of Holland to the Scandinavian rocks. Relations have been discovered between the shapes of grains of sand and the velocity of the currents in which they have been carried and the distance. The length of time the grain has been exposed to the action of water is a subject for further study; and it is hoped that it will be possible some time, by the examination of the fossils contained in a specimen, to determine the probable depth of the water adjacent to the deposits; and from the lessons furnished by a piece of limestone, for instance, to reconstitute the geological ocean in which it originated, estimating the dimensions of the sea, the force and direction of the currents and waves and of the winds that blow over it, and the depth of the water, its temperature, salinity, and density—all, in short, that we are only beginning to learn concerning our present seas.

Customs of Demerara Negroes.—The Demerara boatman, Mr. J. Rodway says, "has great powers of endurance. He can paddle for hour after hour, often against the stream, until you wonder how he bears such a strain. But when his work is done he falls asleep in almost any position. Under the burning rays of a cloudless sun which would blister your face he sprawls down in the *bateau* and sleeps like a dog." With his inclination to sleep during the day the negro will spend the night in gossip, dancing, or singing, and often in such a way as to be a nuisance to his neighbors. Such he is in his wakes, when fifty or a hundred people will gather in the yard, there being no room in the house, and, beginning with hymns and going on after midnight to songs and games,

may wind up toward morning with a free fight. "Then there is the Cumfoo dance, one of the finest institutions in the world for producing nightmare. Two men beat drums with their hands, the one instrument producing a tum-tum and the other a rattle-rattle, almost without intermission during the whole night. At intervals of about a minute the party utters a weird cry in some African language, which startles you as you lie in bed vainly trying to sleep. As hour after hour passes your house appears to vibrate, the bed shakes, and your spine feels as if made up of loose segments." This and other dances are connected with the Obeah, the witch cult of the African. All the negroes and most of the "colored people" have an innate fear of the Obeah man, however much they may deny it to the whites; and Mr. Rodway tells of a captain of a creole cricket club who was sure his side would win a match game because a notable Obeah man had oiled their bats.

Causes of Sudden Death.—Cases of sudden death from natural causes are classified by Dr. J. Dixon Mann under the three heads of deaths which are due to the presence of a disease universally recognized as one liable to terminate with sudden fatality—when satisfactory post-mortem evidence can usually be obtained of the cause of death; those due to the presence of a disease which when fatal does not usually end life abruptly—when the post-mortem evidences are usually inferential rather than conclusive; and deaths which do not result from any ascertainable disease—when no evidence is afforded by post-mortem examination. Heart disease is responsible for about half the whole number of sudden deaths of adults. Apoplexy and other cognate brain diseases rank second to it. Some of the diseases liable to terminate thus may exist without giving rise to any symptoms. Especially is this the case with certain diseases that have a prolonged course. The diseases of the second class are quite numerous, and, though several of them are usually inhibitive of motion when fully developed, they occasionally occur in a latent form, and terminate suddenly without their presence being even suspected. In some cases, with these diseases, the issue may be determined by an overloaded stomach. In a large number of instances the victim was undergoing some exceptional form of physical exertion at the time. In most of the cases in which death suddenly takes place without any cause being revealed on post-mortem examination, it is determined by some external causal influence either acting directly on the nervous system or mediately on it by means of a very slight and apparently totally inadequate physical impact. Therefore, in relation to this group, the term "death from natural causes" includes death arising from external and possibly abnormal influences, which, however, can not be regarded as being essentially lethal. Young children are especially liable to sudden death in a number of ways that do not obtain with adults. Infants die very readily from suffocation. Convulsions due to reflex irritation are a common cause of infantile death; and, finally, sudden death may occur to young children without any ascertainable cause.

Work of the Smithsonian Institution.—Among the publications of the Smithsonian Institution mentioned by Secretary Langley in his annual report is the memoir of Lord Rayleigh and Professor Ramsay on the discovery of argon, for which achievements the authors were awarded the first Hodgkins prize of ten thousand dollars. A memoir by Prof. E. Duclaux, of Paris, describes the methods and results of numerous experiments on the chemical rays of the sun by the exposure of oxalic acid to their action, from which it appears that the chemical activity and hygienic power of the sun's rays are not related to the apparent fineness of the day. The library has grown to contain 35,912 numbers. Special mention is made of the gift of Mr. S. Paleanof, of St. Petersburg, of more than three hundred volumes, mostly of Oriental works, with some Arabic manuscripts and many rare Armenian publications. The collection of Chinese coins, etc., bequeathed by the late George B. Glover, includes 2,025 specimens of Chinese, Annamese, Siamese, Japanese, and Korean coins; amulets and bamboo tally sticks used as money; Chinese paper money; foreign coins in circulation in China; and molds for casting coins—the series dating back to B. C. 770, and being continuous in the coinage of each dynasty. The work of the Bureau

of American Ethnology has been prosecuted in the study of social organizations, linguistics, and decoration, as illustrated in the Indian tribes. The International Exchange Service, instituted in 1852, is still carried on, with 28,008 correspondents on its records, of which 21,427 are foreign. The operations of the Astrophysical Observatory have consisted chiefly in experiments in the bolographic analysis of the infra-red solar spectrum and the preparation of a report thereon. Information has been sought from the institution on all sorts of subjects, and has been furnished, or else the way to get it has been pointed out.

Dinner in the "Zoo."—The appetites of the twenty-five hundred animals, more or less, kept in the London Zoölogical Gardens furnish a curious field for study; and the matter of dealing with them is in some cases one of great difficulty. Only one animal—the hog—seems wholly indifferent as to the nature and quality of its food, and some species are extremely fastidious. Even the ostrich manifests a choice, and shows no relish for the nails and old iron with which it is credited with regaling itself on the African farms; and one species, the Somali ostrich, accepts only green food, refusing to touch the meat and biscuits of which the South African ostrich is very fond. The giraffe is one of the daintiest of beasts, living in nature on the leaves which it strips from trees, and in the gardens on the best clover hay, crushed oats, bran, and chaff, with fresh green tares and an occasional onion as relishes; and while it is very fond of fresh, whole apples, rejects one that has been bitten. Some animals are able to change their native tastes and acquire others, vegetarians becoming flesh eaters, and insect eaters turning to fruit and grain—as the kea, of New Zealand, which, once a strict vegetarian, has become very fond of mutton. Animals in the Zoo have to submit to more or less of this, for their native food is often unattainable. Nothing has been found on which the Australian koala will thrive, but the kangaroos and wallabies take kindly to grass and maize, and breed frequently. Unfortunately, the kangaroos are very subject to gout and corns. The polar bear is happy with horse blubber and plaice, and the crocodiles and alligators are satisfied with raw meat. The apteryx, which at home lives on worms and larvæ, feeds and prospers on imitations carved out of fillet steak.

MINOR PARAGRAPHS.

The debate concerning the presence or absence of considerable bodies of water on Mars has taken a new direction, and observers are now looking for optical evidence. If there is any large body of water on the planet, the image of the sun should be seen, when the proper conditions for the phenomenon exist, reflected from its surface as a fine point of light. No such image has been observed by the astronomers who have busied themselves most with Mars; and the conclusion is drawn that the planet's store of water is derived from the melting of the polar snows. Mr. Taylor, of York, believes that there is enough of this to affect the hue of the vegetation, the existence of which is indicated by dark lines and spots. There does not appear to be anything in this theory to preclude the possibility of Mars having a copious supply of rain.

While admitting that water may be an effective agent in making deposits like loess, M. J. A. Udden adduces reasons in the Bulletin of the Geological Society of America for believing that the loess in the Mississippi Valley was chiefly deposited from the air. It is often found in situations where the agency of water can hardly be predicated, and contains land shells. The universal presence of mineral dust in the atmosphere and its constant settling necessitate its accumulation in places where erosion is at a standstill or does not exceed the rate of atmospheric sedimentation; and the conditions now nearly correspond with this. In mechanical composition fine wind sediments and loess are largely identical. The loess beds are more uniform in structure than deposits from water can well be; and other features of the loess appear easier to explain if it be regarded as a land deposit.

The law of wills and inheritance is cited by Isaac F. Russell, in a paper on the Vendetta, as perhaps exhibiting more than any other

body of justice doctrine the influence of kinship in legal evolution. "In point of historical development intestate inheritance precedes testamentary succession. The conception of a will as a means of disinheriting children and devolving an estate in accordance with the excessive partiality, fleeting caprice, or malignant temper of the testator, is a conception of our modern times, and was not familiar to the jurisprudence of primitive antiquity. In fact, ancient law regarded a will as a means of perpetuating the family in a succeeding generation by nominating a new chief on whom the headship was to be devolved. Little power of free testamentary alienation was recognized. The patriarch was more like a trustee or steward of common possessions belonging to the family than an original proprietor. He could not do as he saw fit with what seemed to be his. Often a son, on coming of age, could compel his father to make a partition of the family holdings, as suggested by Jesus's parable of the prodigal son.

THE ninth of the series of annual abstracts of the Linnæan Society of New York contains a paper on the Fishes of the Fresh and Brackish Waters in the Vicinity of New York City, by Eugene Smith. Mr. Smith has found fifty native, eleven introduced, and twelve probably occurring native species, belonging to fifty-four genera and twenty-four families, showing that while the number of species is not large, the families are well represented. None of the species are limited to a small area of near-by country. "The fresh-water species of New England and of the Maritime Provinces as far as the Gulf of St. Lawrence are nearly all found with us, the exceptions being mostly the absence here of the more northern salmonids. Our vicinity represents a sort of border land between the very restricted fish fauna of the New England 'Zoölogical Island,' as Agassiz called it, and the far richer fauna encountered in the Delaware basin immediately to the west of us," with a few fishes that properly belong to the eastern Carolina basin.

A SINGULAR lithological formation is described by Prof. Persifor Frazer as exhibited by the ore in the Coletta mines of the Northern Black Hills of South Dakota. Uneven lenticular masses of ore have been deposited on the upper surface of the quartzite, suggesting a resemblance to sausages strung together by slender strings. The masses lie approximately in the same plane at intervals of thirty or forty feet, parallel with each other, and are intersected by other similar masses at right angles, the richness and quantity of the ore being increased at the junction. These corrugations, as they are called, are broad and shallow masses from five to twelve feet wide and from eight inches to three feet thick. Where they are united end to end, or at the parts analogous to the connecting string of the sausages, the rock becomes sandy and free gold is found. The strange formation is supposed to be caused by the existence of furrows or troughs in the surface of the quartzite in which the contents of the metalliferous solutions were deposited, but what caused the depressions is not clear.

NOTES.

A TWO-WEEKS' Summer School of Sociology, Economics, and Politics will be held at Syracuse University, Syracuse, N. Y., June 27th to July 9th, when seven hours of classroom work each day—five lectures and a conference of two hours—for eleven days, will be given; with a sermon by an eminent minister on the Sunday, both dealing with the religious bearings of present-day social movements. The lecture courses will be given by John R. Commons, professor of sociology, on Social Philosophy; Charities, Inebriety, Crime, and Child Serving, and City Government; and by Dr. J. H. Hamilton, professor of political economy, on Industrial Problems and Money and Banking. A Co-operative Boarding Club will be organized, by the aid of which and other means of reducing expenses the whole cost of sojourn at the school, including tuition charges will not be more than $14. Inquiries may be addressed to J. H. Hamilton, 306 Waverly Place, Syracuse, N. Y.

AT the summer quarter of the West Virginia University, Morgantown, beginning July 1st and continuing twelve weeks, the teaching of sociology and allied subjects will be a prominent feature. The quarter will be divided into two terms of six weeks each, of which students may enter either or for any part of the quarter. Dr. Lester F. Ward will give two courses of class lectures on Pure and on Applied Sociology, and four public lectures. Prof. J. H. Hamilton, of Syracuse University, will deliver two courses on Money and Banking, and on Industrial Problems (July 11th to August 13th). Prof. J. H. Raymond will deliver two full courses through the quarter on the Principles of Economics

and A Historical Survey of Sociological Thought, and also a series of public lectures on A Group of Social Philosophers. The summer quarter is not a "summer school," but an integral part of the university year, with all the departments in operation.

In a bulletin of the New Hampshire College Agricultural Experiment Station on dehorning cattle, the horns of cattle are described as consisting of two parts of different origin; the outer horny shell, derived from the skin, and the bony inner part or pith, derived from the skull. These parts are undeveloped in the infant calf, but begin at once to grow. If removed after some development, they must be cut away, the cut being made deep enough to remove the matrix. In calves the as yet soft and growing points of the horns are of small extent and can be destroyed with little trouble by the simple application of caustic potash or caustic soda. When properly applied, either substance destroys the matrix or growing point of the horny tissue and the underlying periosteum. In calves a few days old a surface half an inch or a little more in diameter will destroy these parts.

The announcement for the third year's work of the "Marienfeld summer camp for boys" is just received. The camp opens on the last day of June and closes on the 1st of September. It is meant to offer a thoroughly wholesome outdoor life for boys during the summer months, and to provide enough of the intellectual element to keep a sound balance of character. Professor Hendersen's ability as an instructor and the care with which the moral and social training of the members of the camp is carried on should make a summer's residence at Marienfeld an extremely valuable experience for the growing "youngster."

A rather unique cold pack is described by an English practitioner of Constanta, Roumania. He was called in to visit a Roumanian boy suffering from typhoid fever. He found the child's head wrapped in a white sheet, which he shortly observed to be moving; presently a small frog crept out on the pillow, and further examination revealed two or three dozen more, which the mother said she had been told to apply by some other doctor.

Some interesting revelations are made by correspondents of Nature concerning the refractoriness of insects to poisons. The caterpillar of the spurge hawk moth feeds on sea spurge, a plant that secretes an acid juice "so painfully poisonous that it is difficult to imagine a digestive apparatus competent to deal with it"; a druggist of Sydney, New South Wales, found weevils feeding and thriving on wheat soaked in strychnine; a certain caterpillar feeds on the virulent poison contained in the kernel of the seed of *Physostigma venenosum* and is not affected by it, while it is killed by hydrocyanic acid; and a weevil feeds with impunity the in last-named poison. The subject is an interesting one for investigation.

Two oceanic meteorological observatories have recently been established on the Azores, one on the island of San Miguel and the other on the island of Flores. The San Miguel observatory has regular cable connection with some of the European observatories, and that of Flores, although not yet in cable connection, promises to be very important. By the aid of these stations the European meteorologists hope to be warned of the approach of storms fifty hours in advance.

The French Journal *Le Veto* has counted 852 pieces in a bicycle, and adds that by closer searching we might find more.

An effort is making in Utrecht, Holland, to erect a monument by international subscription of Buys Ballot, the famous Dutch meteorologist, whose name has been given to one of the fundamental laws of the modern science.

The list of recent deaths among men of science includes the names of Bradney B. Griffin, author of papers on the fauna of the northwest coast of America, and of important papers on subjects of cellular biology, March 26th; M. Aimé Girard, professor of industrial chemistry in the *Conservatoire des Arts et Metiers*, in Paris, who was distinguished for his researches in the chemistry of vegetable fibers, wheat, meal, sugars, and drinks; T. Kirk, a New Zealand botanist, chief conservator of state forests, and author of Forest Flora of New Zealand; Dr. George Dragendorff, professor of astronomy at Rostock; Dr. F. Sandberger, professor of mineralogy at Würzburg, aged seventy-two years; Jules Marcou, a distinguished French and American geologist, at one time professor of geology at Zurich, author of geological maps of the United States and of the world, and of numerous scientific papers, at Cambridge, Mass., April 18th, aged seventy-four years; Alfred U. Allen, originator and secretary of the Postal Microscopical Society and formerly editor of the Journal of Microscopy and Natural Science and of the Scientific Enquirer, at Bath, England, March 24th; Colonel Sir Vivian D. Majendie, inspector of explosives, London, April 24th; Dr. J. S. Hyland, a young mineralogist and petrologist of much promise, who was author of papers on petrological subjects, and at one time connected with the office of mineral resources of the United States, on the west coast of Africa, April 19th, aged thirty-two years; and Melville Atwood, geologist and metallurgist, who devised improvements in the working of zinc ore and introduced the blanket system of amalgamation, at Berkeley, Cal., April 25th, aged eighty-six years.